DECEMBER 1, 1952

Electrical World

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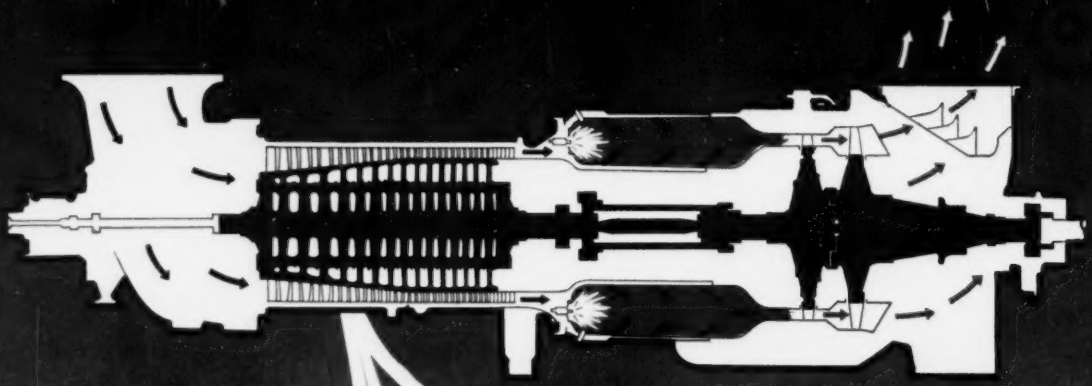
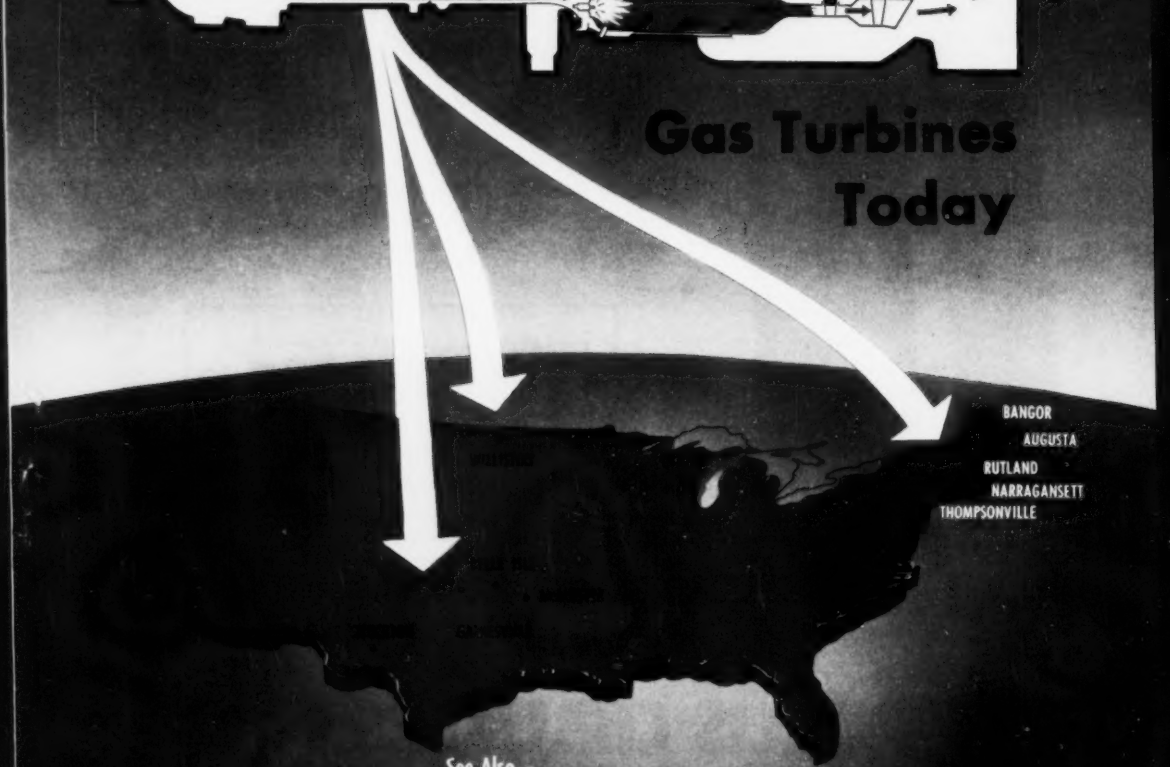


Gas Turbines Today



See Also—

Trends in Transmission Voltage • New York's New Aluminum Cable

ALLIS-CHALMERS

5/8% STEP VOLTAGE REGULATORS

Keep Revenue Up

as feeder loads increase

SOMETIMES IT'S QUITE A WAIT for construction crews to get overloaded feeders rebuilt. But you won't be losing revenue during the waiting period if you have Allis-Chalmers distribution regulators on the line. They guarantee an accurate ± 1 volt band that keeps revenue — and profits — climbing with increases in loads.

Best of all, you've got a flexible tool for solving voltage problems anywhere. Allis-Chalmers distribution regulators are easy to mount — they can be shifted from feeder to feeder easily as changing loads require.

Don't let rising loads cut into profits. Call your nearest A-C district office for full information. Or write Allis-Chalmers, Milwaukee 1, Wis.

A-3881

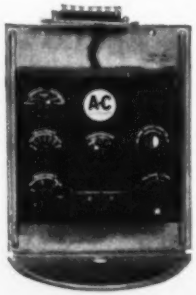
RATINGS AVAILABLE	7620 Volts—15, 50, 100 amp 5000 Volts—50, 100 amp 2500 Volts—100, 200 amp

Feather-Touch controls cut service costs

Setting the control when you install an Allis-Chalmers distribution regulator is easy, thanks to the convenience of *Feather-Touch* controls. There's only one adjustment needed — setting the calibrated voltage level.

Maintenance is equally easy because a single jack plug connects all wiring to the regulator. The control can be removed and replaced in a jiffy.

Get all the facts. Write for bulletin 01M7866-1.



ALLIS-CHALMERS

Originators of 5/8% Step Regulation

A Gas Turbine Booster

The gas turbine probably doesn't know it, but it owes much to the promotion given it by B. G. Hatch of the gas turbine section of General Electric Co at Schenectady. So far he has made over 80 speeches on the new type of prime mover to technical and engineering groups in all sections of the country. This issue, Electrical World gives him an assist in his campaign by publishing his article, "Is the Gas Turbine Tomorrow's Prime Mover?" (See page 101)

B.G., as his friends call him, wasn't always a gas turbine promoter. Previous to 1946 his field was steam turbines for ship propulsion and other such items that helped win the war. But originally his job was in the general sales department of GE's central stations division. He spent about 25 years working out of Schenectady, Los Angeles and New York.

Started in Test Course . . . Like many other GE men he started in the test course. This was in 1919 following his graduation from the University of Illinois. He got his pre-electrical engineering training at Bradley College in his home town, Peoria, Ill.

In 1922 Brainard (that's his official first name) married a Schenectady school teacher. They have a son and two daughters. As B.G. says, these children brought home six grandchildren and a dog. The dog is a collie-shepherd.

Lured to the River . . . The Hatch estate consists of 16 acres located on a cliff some 120 ft above the Mohawk River. The view is splendid, 12 miles of the river gorge country. As fiction writers would say, "The river has drawn B.G. to it. He has succumbed to its irresistible lure." As this is not fiction, we will merely say he has become an ardent boatman.

He has built, operated, and sold two motorboats (conventional motors, no gas turbines). Now in a cruiser that he purchased, he spends his summer spare time going as far as Long Island Sound. And we bet as he cruises along he thinks of gas turbines.

Electrical World

Published for 78 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol. 138 No. 22 — December 1, 1952

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Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 N. Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are accepted from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.

Single copies 25¢. For the United States and possessions $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter, November 18, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in USA.

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all through the storm no outages with OKOLITE-OKOPRENE CABLE

Even with a large elm tree blown against it, Okolite-Okoprene self-supporting aerial cable stayed in service during a recent heavy storm in New England.

A recent electrical and wind storm in New England was so violent that a number of lives were lost and property damage was severe. In the center of the storm area, a local utility had several miles of Okolite-Okoprene self-supporting aerial cable in operation. A section of the three-conductor non-shielded Okolite-Okoprene cable bound to a Copperweld messenger is shown in the photograph above.

Although poles were broken and up-rooted trees were entangled with the wires and cables in this area, there was not one instance of failure in the Okolite-Okoprene cables.

Customers frequently report that heavy limbs, and even trees, have been temporarily supported by the strong messenger in Okolite-Okoprene self-supporting cable, and in cases where storms have forced the line to the ground, the cable has remained in operation since the Okolite insulation and the Okoprene sheath afford full-voltage protection.

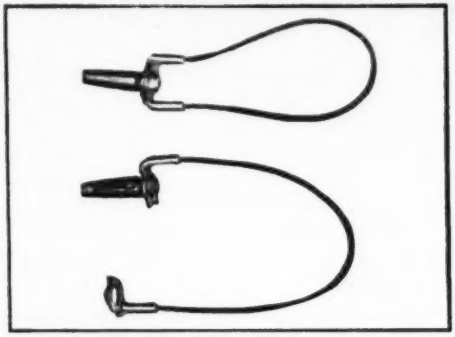
You'll find a number of good reasons for using Okolite-Okoprene self-supporting aerial cable discussed in Bulletin EW-1058. If you are in an area where wind storms are prevalent, you will be especially interested. The Okonite Company, Passaic, N. J.

The best cable is your best policy

OKONITE SINCE 1878 *insulated wires and cables*

Electroline AUTOMATIC DEAD-END

for Neutral Supported Multiple Conductor Service-Drop Cable



THE 4000 SERIES ANCHOR BRACKET

This Electroline Automatic Dead-End is designed for use with neutral-supported type of service drop. The insulation on the phase wires is not destroyed because these Dead-Ends grip only the bare neutral. This eliminates the possibility of shorting any phase. Available only for No. 6-AWG conductor. For automatic line Dead-Ends use the Electroline 3400 Series.

THE ELECTROLINE 3800 SERIES Automatic Dead-Ends lower construction costs because they are easily installed in a few seconds. This Dead-End is assembled as a one-piece unit with no loose parts to be dropped or lost. One end of the flexible bail is detachable for use with a spool-type insulator or other types of supporting anchorages now in service. This feature permits quick and easy installation with only one part, other than the conductor, to be handled by the lineman.

ELECTROLINE 4000 ANCHOR BRACKET — The 4000 Series Service Bracket, for use on permanently multi-grounded neutral systems (ideal for use with 3800 Series Dead-Ends as illustrated below), permits quick and simple insertion of a closed bail or loop—supports the cable at any angle. Installation costs are further reduced since this method of anchoring eliminates the insulator and insulator hardware.

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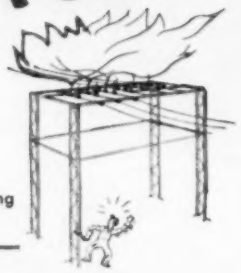
Alduti INTERRUPTER SWITCHES



① Where Horn Gap Switches Are Inadequate

because horn gaps cannot, under all conditions, safely break magnetizing or charging currents; nor can they interrupt load currents

② Where Circuit Breakers Are Too Expensive

for non-automatic switching and short circuit protection

ALDUTI INTERRUPTER SWITCHES

offer a proved and economical solution to such application problems.

Ten years of operating experience in thousands of installations, and many field trials under severe test conditions, have demonstrated the ability of these Interrupter Switches to — safely and repeatedly —

- Sectionalize either radial or loop distribution and subtransmission circuits, under either load or charging current conditions . . .
- Switch load and magnetizing currents of transformer banks . . .
- Switch charging currents of capacitor banks.

And because there is NO EXTERNAL ARCING during the operation of Alduti Interrupter Switches: they need not be mounted horizontally upright, but can be mounted vertically, or underhung; hook stick operation can be employed where economy dictates; and phase spacings can be reduced to 18 inches for the 7,500-volt and 33 inches for the 34,500-volt switches. Hence structures can be smaller, connections simpler, and construction cost can be reduced below that of installing horn gap switches.

Also, Alduti Interrupter Switches can be metal-clad, thus providing—even for subtransmission applications — enclosed "packaged-type" switches, thereby permitting the complete enclosure of all components of a substation.

When combined with S&C Power Fuses, Alduti Fused Interrupters also provide short circuit protection with fault current interrupting ability up to 40,000 amperes asymmetrical, thus making possible the elimination of expensive circuit breakers where automatic switching is not required.

Alduti Interrupter Switches are supplied in these ratings:

Volts	Continuous Amperes	Interrupting Amperes, Nominal
For hook stick or group operation		
7500 & 15000	400, 600, 1200	400, 600
For group operation only		
23000 & 34500	600	600

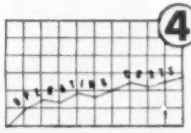
S&C ELECTRIC COMPANY

Formerly SCHWEITZER & CONRAD, INC. In Canada, Powerlite Devices, Limited, Toronto

give you Great Advantages:

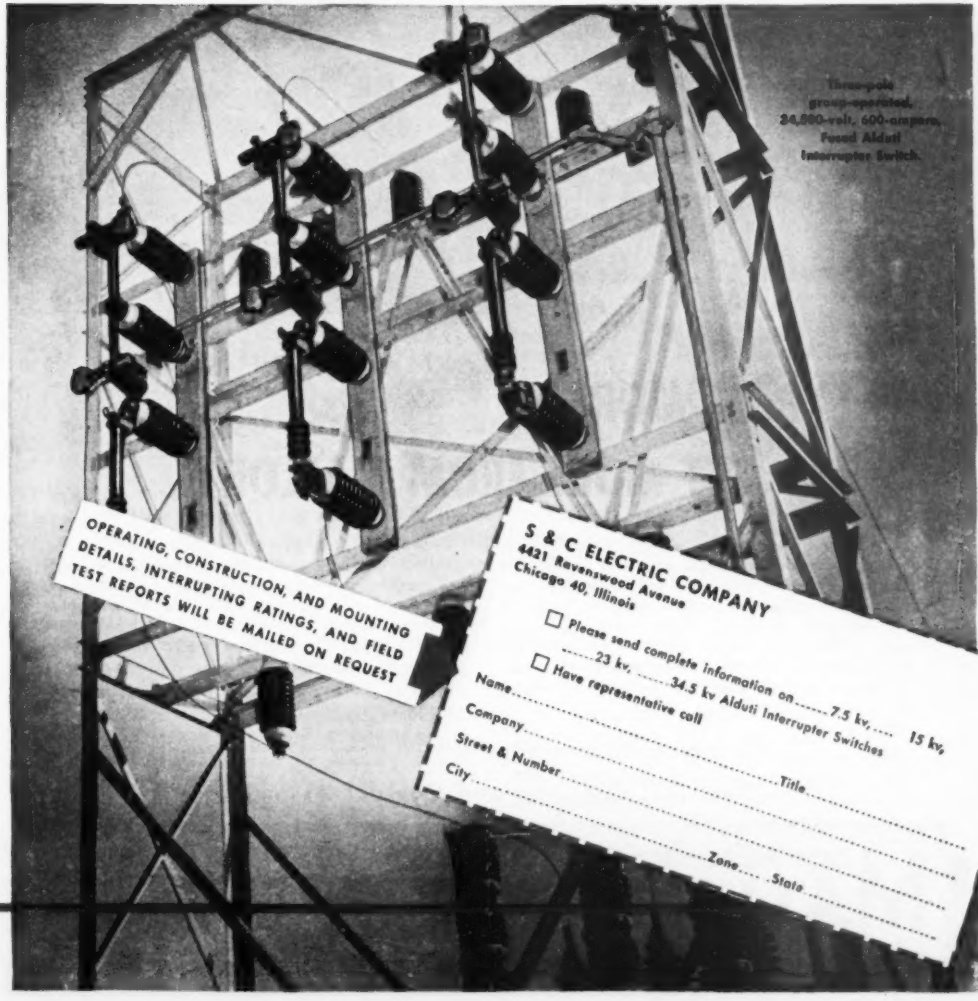
③ Where Structure Design Is Restricted

because horn gap switches can be mounted only in the horizontal upright position, and need wide phase spacings



④ Where Switching Sequences Are Complicated And Costly

because multiple operations—involving breakers, disconnects, and operating personnel— are required to isolate equipment or sectionalize circuits



Three-pole group-operated, 34,500-volt, 600-ampere, Fused Alduti Interrupter Switch.

OPERATING, CONSTRUCTION, AND MOUNTING DETAILS, INTERRUPTING RATINGS, AND FIELD TEST REPORTS WILL BE MAILED ON REQUEST

S & C ELECTRIC COMPANY
4421 Ravenswood Avenue
Chicago 40, Illinois

☐ Please send complete information on ..... 7.5 kv, ... 15 kv, ... 23 kv, ... 34.5 kv Alduti Interrupter Switches

☐ Have representative call

Name ..... Title .....

Company .....

Street & Number .....

City ..... Zone ..... State .....

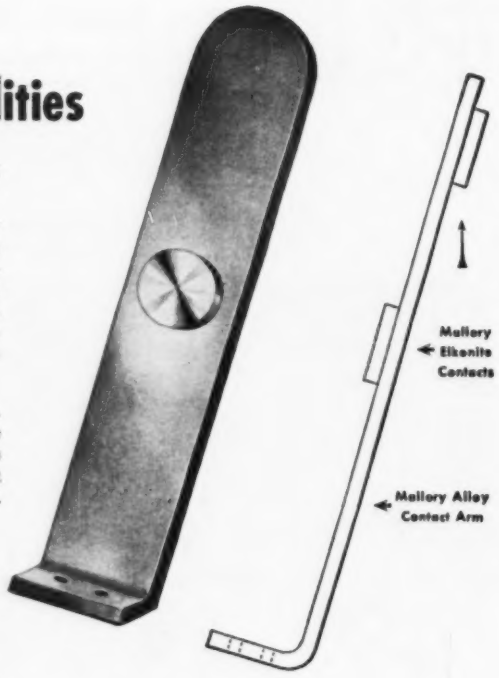
Why let electrical contact assembly snag your production?

Call on MALLORY Contact Assembly Facilities

You can save time, money and effort by turning to Mallory for your electrical contact assemblies.

This contact assembly for an electrical power control is an example of Mallory ability in design refinement and production economy. The contacts must break heavy currents without sticking. The contact arm needs low electrical resistance, and must withstand repeated impact without distorting. And the complete assembly must be produced at reasonable cost.

Through the use of Mallory Elkonite® contacts . . . high-strength Mallory copper-base alloy for the contact arm . . . special Mallory brazing methods . . . Mallory designed and produced an assembly that met all requirements of dependability and economy.



EXPECT MORE... GET MORE FROM MALLORY

If you have been producing your own electrical contact assemblies, it will pay you to investigate the advantages of Mallory Assembly Engineering. You can rely on Mallory to produce the right contact at the right price. Your requirements receive the attention of Mallory specialists who have pioneered the development of new alloys, brazing techniques and fabrication methods especially applicable to contact assemblies.

Production of complete assemblies in Mallory's recently expanded plant relieves you of all problems of purchasing, stocking, and fabrication of component parts and sub-assemblies. The finished assemblies delivered to your plant are backed by Mallory's single responsibility, extending all the way from raw materials to final inspection.

Write to Mallory today about your contact assembly problem.

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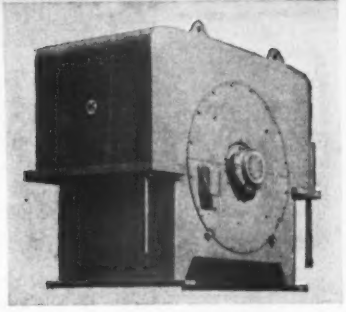
NO HOUSING PROBLEM

. . . with this Outdoor Motor

Weather-Protected MOTORS



BEST WAY to solve a housing problem is to eliminate the need for housing! That's exactly what the Allis-Chalmers weather-protected motor does. It eliminates the need for a costly building . . . costly in added capital investment, costly in upkeep, and costly in extended construction time.

Proved by Special Tests

We know this weather-protected design can give you these savings . . . plus dependable performance . . . because we've tested it under extreme conditions.

Take the 900-hp, 435-rpm, 4160-volt motor shown above. While running at normal speed and voltage, it was deluged with water at rates up to 40 inches per hour — driven by winds up to 75 miles per hour. This was done repeatedly from all angles. But on inspection, no moisture was detected on the windings of this weather-protected motor.

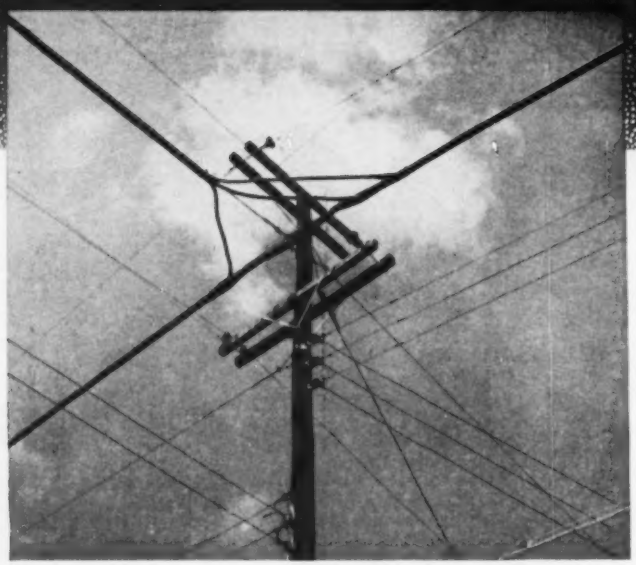
And other tests checked its effectiveness in keeping out wind-driven fine sand.

Bulletin Describes Features

The construction features that provide this economical, super-splashproof performance are available in ratings for all major auxiliary drives. For more information, ask your nearby A-C representative for Bulletin 05R7874, or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3907

ALLIS-CHALMERS

DO YOUR OVERHEAD LINES LOOK LIKE THIS?



This photograph shows many of the reasons why you should consider installing aerial cable instead of line wire. Notice what a neat, compact job the linemen have done and how unobtrusively the cable fits into the picture. Wouldn't you like your overhead lines to look like this?

It is a safe job too because the cable is completely insulated. Even if the cable should fall, which is highly unlikely, there is little or no danger to passers-by. Experience has shown that insulated aerial cable is the safest form of above ground transmission. Wouldn't you like that?

Notice how flexible the installation is too. See what a good looking "Y" tap has been taken off and notice the streamlined appearance of the splices. There is little danger here from swinging arcs or grounds caused by wet conditions. This type of an installation will reduce your trouble calls from owners of television sets. Wouldn't you like to increase safety and cut down on customer complaints?

Insulated aerial cable leaves the pole in an uncluttered state. Wouldn't you like to leave the impression with your customers that you practice good housekeeping?

These advantages and more can be yours if you use Simplex Aerial Cables. You will find that they are exactly what you want. They are made in various styles and sizes to meet varying conditions. Want more information about these versatile distribution lines? A note to the address below will bring it to you without obligation.

Simplex - WIRES & CABLES

SIMPLEX WIRE & CABLE CO.
79 SIDNEY STREET,
CAMBRIDGE 39, MASS.

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CIRCUIT BREAKER LOAD CENTER LINE!

See XO

1 to 32 Circuits

Only six devices form the basic XO line in general purpose enclosures.

Main Breakers

For the first time! Load centers with main breakers for 1 phase, 3 wire or 3 phase, 4 wire devices.

1 Phase, 3 Wire - 3 Phase, 4 Wire

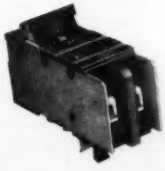
To meet modern trends in distribution. Both raintight and general purpose.

Raintight

All enclosures are Underwriters' approved. Available with or without provision for the popular interchangeable hubs.

"Plus" Applications

The XO solves specific water heater, switched neutral and other split bus problems—in many cases with standard components.



XO Plug-in Units have ALL the Features...

1. **Quick-Make, Quick-Break** operation at no extra cost.
2. **Ambient Compensation** ends nuisance tripping. No extra cost.
3. **Thermal-Magnetic**—complete two-way protection against both moderate and heavy overloads.
4. **Non-Interchangeable feature** prevents higher capacity 30, 40, 50 ampere sizes from being substituted for 15 and 20 ampere breakers. Discourages tampering.

Off-the-Shelf Delivery

Just 3 components simplify selling and stocking. Box with interior, cover, and plug-in breakers. Breakers conveniently packed in individual boxes and multi-packed in cartons. All the sales features—highest quality, no cost premium, immediate delivery.

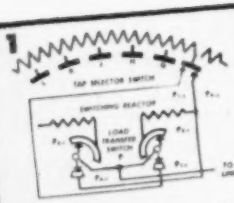
ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

It's the Principle of

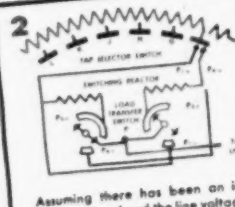
These schematic diagrams show the sequence of switching operations. Switching reactor loss is eliminated in all operating positions on 1¼% step voltage regulating apparatus and in half of the positions on ⅝% step voltage regulating apparatus. Colored lines indicate paths of current.

1



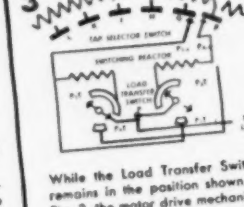
Switch positions for Load Tap Changer Operating Position No. 1 on either ⅝% or 1¼% step voltage regulating apparatus (assuming Reversing Switch is in Buck position). A 10% voltage buck is provided in this position. Note that reactor is by-passed.

2



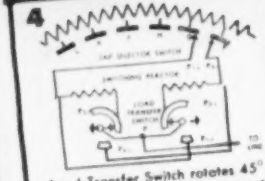
Assuming there has been an increase in load and the line voltage decreases, the Automatic Control, after a time delay, actuates the driving motor. The motor drive mechanism rotates the Load Transfer Switch 45° counter-clockwise, shunting all of the current through one half of the Switching Reactor.

3



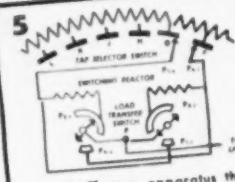
While the Load Transfer Switch remains in the position shown in Fig. 2, the motor drive mechanism continues to operate and rotates the Tap Selector Switch to the bridging position illustrated above. No arcing takes place since no current is flowing through moving contact P1-1.

4



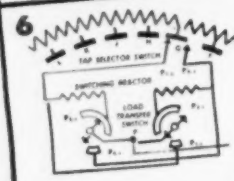
Load Transfer Switch rotates 45° counter-clockwise causing current to flow through both halves of reactor. Load Tap Changer is now in bridging position which is Operating Position No. 2 on ⅝% step apparatus and tap change has been completed. On 1¼% step apparatus this is a transitory position.

5



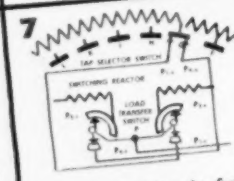
On 1¼% step apparatus the motor drive continues to operate and rotates the Load Transfer Switch 45° counter-clockwise, again shunting all of the current through one half of the reactor in preparation for the movement of the Tap Selector Switch to its next position.

6

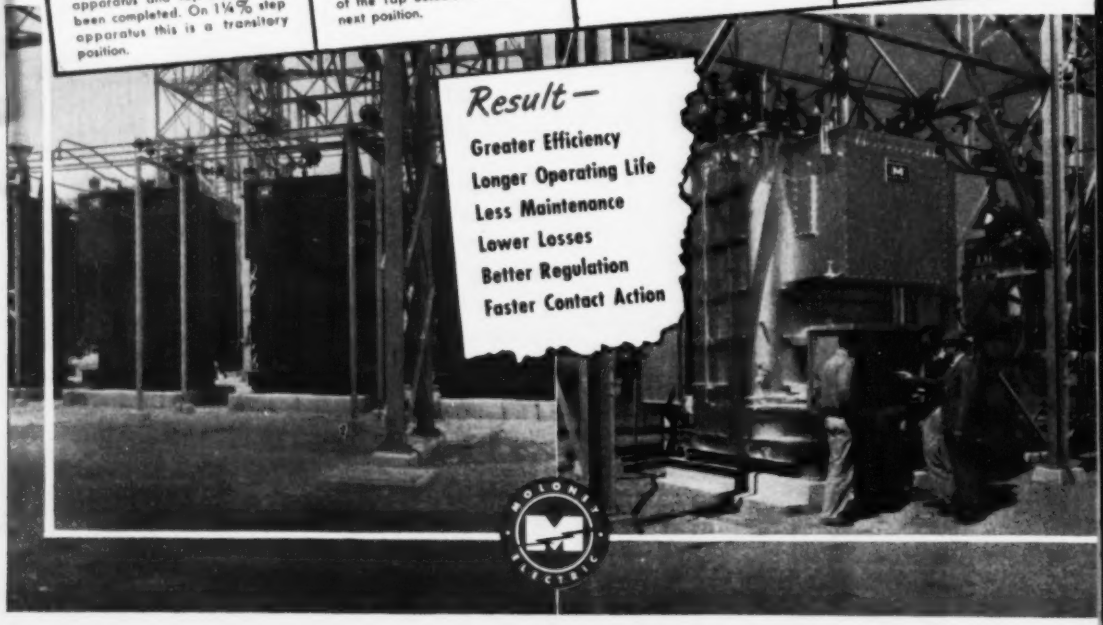


With no current flowing through moving contactor P4-1, the Tap Selector Switch now moves to the next position with P1-1 and P4-1 on stationary contact G.

7

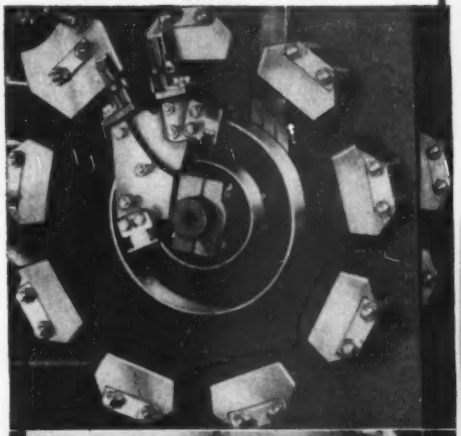


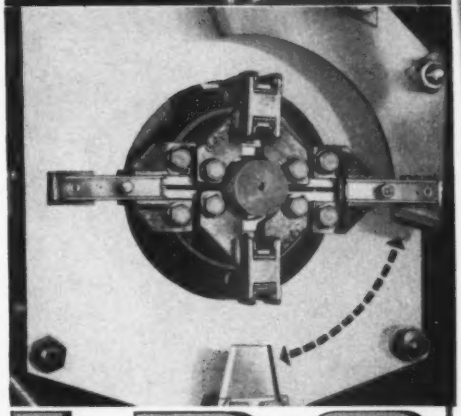
Next, the Load Transfer Switch rotates 45° counter-clockwise to complete the tap change. There is no reactor loss since the current flows through parallel by-passing circuits P1-1, P1-2, P and P4-1, P4-2, P to the line. Load Tap Changer is now in Operating Position No. 2 on 1¼% step apparatus.



the thing

...that makes *MOLONEY* LRC *EQUIPMENT* the outstanding performer in the Voltage Regulating Field





How it Works

ELECTRICALLY

No arcing duty is imposed upon any of the tap selector switch contacts, avoiding the necessity for replacement due to burning or scoring. A separate switch is used for breaking load current, and a reactor in parallel with this switch during each opening and closing keeps arcing here to a minimum. Virtual elimination of arcing not only prolongs the life of the contacts but also preserves the quality of the oil in the tap changer compartment.

MECHANICALLY

The load transfer switch, which is the only switch required to transfer load current, is provided with accelerating springs and is driven by Geneva gears. The design provides a means of opening and closing the load transfer switching elements at a high rate of speed without shock to the gearing or other parts.

Moloney Load Ratio Control Equipment is provided on Load Ratio Control Transformers, Power Regulating Transformers, and medium and large ratings of Step Voltage Regulators.

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers Step Voltage Regulators • Unit Substations

SAINT LOUIS 20, MISSOURI

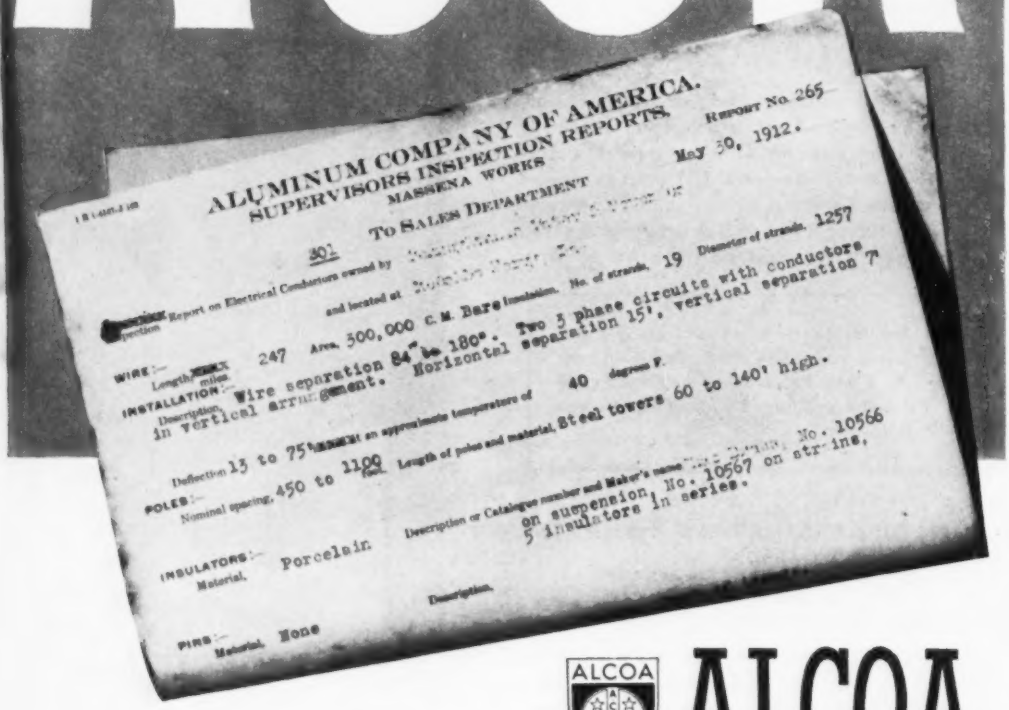
ME-52-31

LRC

MOLONEY
LOAD RATIO CONTROL

FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

ACSR



ALUMINUM COMPANY OF AMERICA.
SUPERVISORS INSPECTION REPORTS.
MASSENA WORKS
REPORT No. 265

To SALES DEPARTMENT

May 30, 1912.

301

Report on Electrical Conductors owned by [redacted] and located at [redacted]

WIRE:— Length, miles 247 Area 300,000 C.M. Bare Insulation. No. of strands 19 Diameter of strands .1257

INSTALLATION:— Description. Wire separation 84" to 180". Two 3 phase circuits with conductors in vertical arrangement. Horizontal separation 15', vertical separation 7'

Deflection 13 to 75' at an approximate temperature of 40 degrees F.

POLES:— Nominal spacing, 450 to 1100 feet. Length of poles and material, Steel towers 60 to 140' high.

INSULATORS:— Material. Porcelain. Description or Catalogue number and Maker's name [redacted] No. 10566 on suspension, No. 10567 on strains, 5 insulators in series.

Description.

PINS:— Material. None

ALCOA

ALUMINUM

ALCOA

and Alcoa Experience

Shown here is an Alcoa field service report dated May 30, 1912. It's one of several made on a line that's still in service. In the forty years since the report was written, we've been adding constantly to our firsthand knowledge and on-the-job experience by cooperating with our customers in the field.

Alcoa entered the aluminum conductor business over 55 years ago. We've been in it...leading the field...ever since. Those years of high line experience on thousands of successful jobs, the reports of Alcoa experts who have helped string lines throughout the country, have been incorporated into Alcoa's manufacturing techniques.

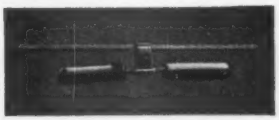
That's why you get the highest quality wire and cable, aluminum or ACSR, from Alcoa. Cable with uniformly correct stranding . . . a galvanized steel core that meets ASTM specs. Quality features built into the product by careful Alcoa workmanship, checked by rigid Alcoa inspection, backed by half a century of Alcoa experience.

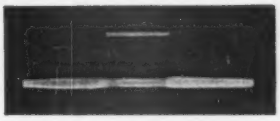
Look to Alcoa for your aluminum wire and cable . . . and buy with assurance!

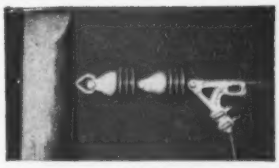
ALUMINUM COMPANY OF AMERICA
2168-M Gulf Building • Pittsburgh 19, Pennsylvania

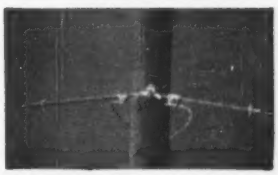
ALCOA ACCESSORIES

Alcoa offers a complete line of job-proved accessories for aluminum cable and ACSR.





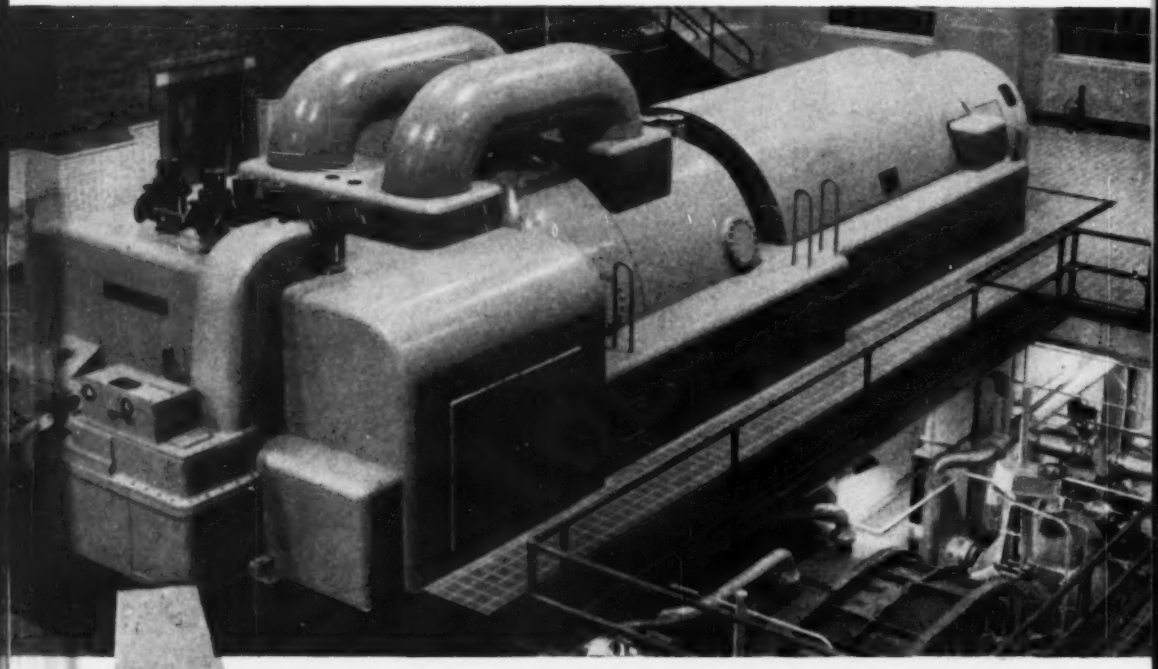




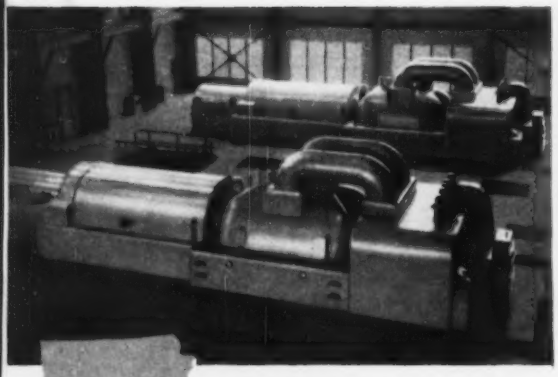
"SEE IT NOW" with Edward R. Murrow — CBS-TV every Sunday . . . brings the world to your armchair. Consult your newspaper for local time and channel.

FIRST IN ALUMINUM
FIRST IN A·C·S·R·

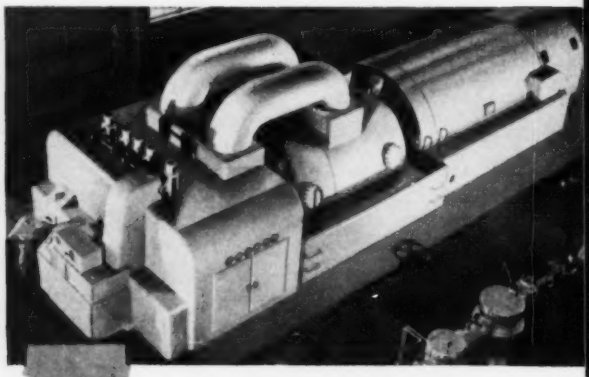
POWER for the



ALABAMA area has experienced an industrial power consumption rise of over 12½% in one year's time. To help meet this rocketing power demand, the Alabama Power Company just recently installed this Allis-Chalmers 40,000 kw steam turbine hydrogen cooled generating unit at its Chickasaw station in Mobile. A-C also supplied the 30,000 sq ft surface condenser and its auxiliaries, including two 25,000 gpm circulating pumps and motors.



ARKANSAS has the largest U. S. deposit of bauxite ore, primary to the production of aluminum. These two Allis-Chalmers 40,000 kw condensing, tandem compound steam turbine hydrogen cooled generating units form the Lake Catherine steam-electric station of the Arkansas Power & Light Company. Most of this power is used to electrolytically reduce alumina.



LOUISIANA industry and agriculture are mushrooming. The Gulf States Utilities Company — serving an area from Baton Rouge to across the Brazos River in Texas—has doubled its customers and tripled its power generation in the last decade. A-C recently supplied 75,000 kw in generating capacity to Riverside station near port city of Lake Charles. Unit shown is 40,000 kw.

Booming South!

NEW ALLIS-CHALMERS TURBINE-GENERATORS HELP SUPPLY MUSHROOMING INDUSTRIAL DEMAND

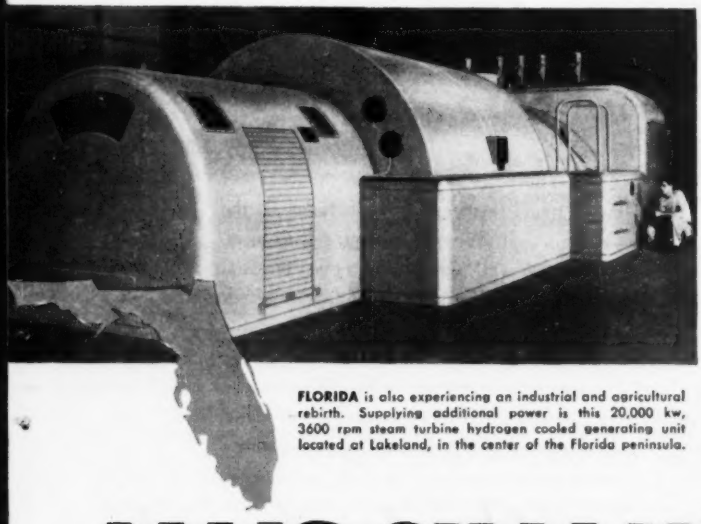
YOU'VE HEARD OF the South's mushrooming industrial growth. Here are some of the Allis-Chalmers steam turbine generator units newly installed to help satisfy that insistent power demand.

All these modern units conform to AIEE-ASME preferred standards in addition to incorporating many exclusive Allis-Chalmers main design features. The hydrogen cooled generators all have the A-C originated "walk-in" exciter housings. And these 3600 rpm turbines all have the following outstanding features:

Hydraulic control and operation with accessible placement of main stop valve; centralized grouping of operating controls; cam-operated inlet valves accessibly located on top of cylinder; and exclusive A-C method of temperature compensation for horizontal *and* vertical thermal movement.

All oil piping is above the floor, simplifying foundation and installation. And, as throughout the complete Allis-Chalmers line—ranging from the smallest single cylinder machines to single shaft, tandem compound, condensing units of 150,000 kw—labyrinth steam seals are used. The steam sealed gland system is self-contained and provides dependability with minimum attention.

You get the real design advances *first* from Allis-Chalmers. When planning the installation or expansion of your steam-electric power plant, let A-C simplify your problem. This *one* source will provide you with the world's widest range of power plant equipment. For your copies of literature on all products mentioned, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3842



FLORIDA is also experiencing an industrial and agricultural rebirth. Supplying additional power is this 20,000 kw, 3600 rpm steam turbine hydrogen cooled generating unit located at Lakeland, in the center of the Florida peninsula.

ALLIS-CHALMERS *firsts*

Simplified hydrogen seal and control

World's lowest exhaust pressure steam turbines

Solidly-bolted-down steam end pedestal

Turbine for one-boiler-per-turbine arrangement

"Walk-in" exciter housing

30,000 kw, 825 F turbine, in 1931

825 F reheat turbine, in 1935

AND NOW...First with supercharged hydrogen cooling!

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

World's Widest Range of Power Plant Equipment

TURBINES & GENERATORS | CONDENSERS & PUMPS | SWITCHGEAR & BREAKERS | MOTORS & CONTROL | TRANSFORMERS | WATER CONDITIONING

The most *Comprehensive* line of dependable PANEL INSTRUMENTS

There are no blanks in the WESTON line of panel instruments. It includes all the sizes . . . all the types, ranges, sensitivities, too. Many specials, as well; developed to meet unusual requirements. All are built in the finest WESTON tradition for sustained accuracy over years of dependable service. Your local WESTON representative will gladly cooperate on any panel instrument problem, or write direct to . . . WESTON Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey . . . *manufacturers of Weston and Tag instruments.*

WESTON PANEL *Instruments*

797

COMING UP . . TEST No. 257, 253 . . and a NEW BENEFIT for you!

Twenty-seven years ago an engineer closed a switch and a heavy current surged through a breaker. This was Test No. 1 in the Westinghouse High Power Laboratory. Through the years, over 255,000 tests have been made in this laboratory to prove every advance in Westinghouse Switchgear design.

A documentary record has been maintained of every test in this laboratory since 1925, to provide a fund of factual data and cumulative knowledge. Included in this vast file of readily available records and reports are tests of every one of the complete line of circuit breakers—indoor and outdoor, air and oil, floor and frame-mounted—and of numerous other products such as metal-clad switchgear, disconnecting switches, isolated phase bus, etc.

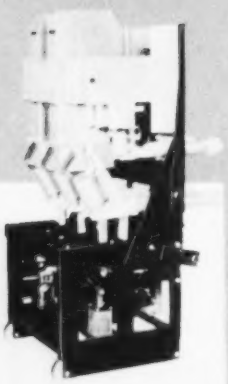
Now comes Test No. 257,253 on a power circuit breaker. From the test record will come factual data on the operating performance of this breaker design and a permanent record to supplement the cumulative knowledge obtained from the laboratory's previous tests. Thus Westinghouse is constantly in a position to build improved products for your present and future requirements.

HIGH POWER LABORATORY TESTING CREATES BETTER PRODUCTS FOR YOU

See "Electrical Proving Ground" . . . the dramatic story of the Westinghouse High Power Laboratory in sound and color motion picture. For details see your Westinghouse representative, or write Westinghouse Film Division, Box 868, Pittsburgh 30, Penna.

ELECTRICAL PROVING GROUND

WESTINGHOUSE SWITCHGEAR *is Design-Proved to the Last Detail*



DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY

When you install Westinghouse Switchgear you are providing the *surest* protection available for your system. You have assurance of dependable performance because all Westinghouse Switchgear designs have been tested and verified in the Westinghouse High Power Laboratory.

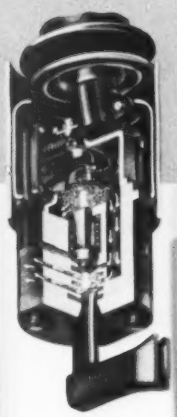
Breaker designs are tested to prove their adequacy within their rating. The cell structure has demonstrated its ability to withstand the stresses resulting from fault current. Venting of arc gases, bus bracing, bus insulation, instrument transformers, disconnecting contacts—every switchgear component—has been checked and found adequate in tests duplicating the most severe service conditions.

Knowing that your switchgear design has been verified in the Westinghouse "Electrical Proving Ground" is a matchless advantage. It's one you always get when you specify . . . Westinghouse.

Complete information on Westinghouse Switchgear is contained in Booklets B-5282 (Low-Voltage), B-5306 (Metal-Clad) and B-5285 (Station Cubicles). For your copies write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE... IF IT'S

The seal that safeguards your investment



WESTINGHOUSE OIL CIRCUIT BREAKERS *feature Exclusive Laboratory Developed De-ion® Grids*

In its 27 years of operation, the Westinghouse High Power Laboratory has given you many important developments such as the De-ion Grid. As an exclusive feature of all Westinghouse oil breakers, the De-ion Grid answers your need for higher interrupting capacities and faster interruption of line faults.

The secret of faster interruption is the multiflow principle of the De-ion Grid which produces an extremely high rate of deionization of the arc space at current zero. Moreover, this faster interruption is accompanied by reductions in the arc energy and lower mechanical stresses and tank pressures. This makes possible the lower oil content breakers, such as the "Watch-Case" breaker shown above.

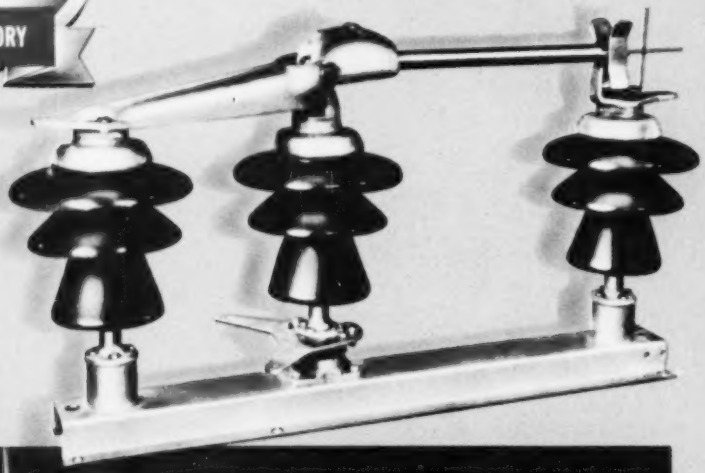
The growth and interconnection of high-voltage transmission systems and high concentration of generating capacity emphasize *your need* for *proved* protective equipment. You *can* be sure when you specify Westinghouse Power Circuit Breakers.

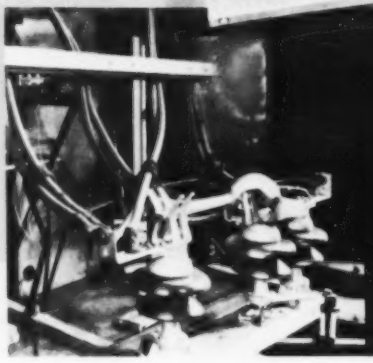
Complete information on Westinghouse Power Circuit Breakers is contained in Booklets 3686A (15 to 69 kv) and 4012 (115 kv and above). For your copies, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

Westinghouse

DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY

The seal that safeguards your investment





WESTINGHOUSE TYPE V SWITCH... *Laboratory-Proved Leader in Disconnect Field!*

The development of the Type V Switch gave you a disconnecting device of unequaled dependability. A departure from conventional switch design, the Type V provided for the first time enclosed pole-unit parts, single-piece break jaws, oilite bushings and single-line high-pressure contacts—without troublesome flexible shunts.

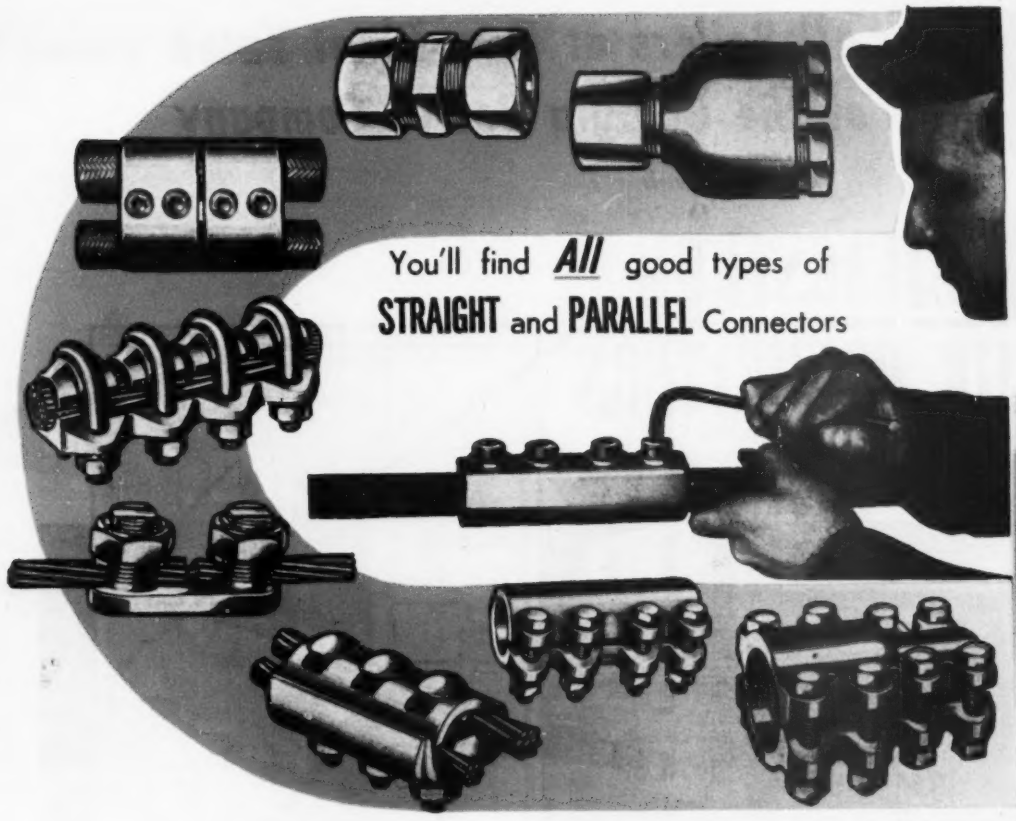
Tested at the Westinghouse High Power Laboratory, the new design was proved at basic impulse insulation levels . . . at NEMA Standard short-time ratings (illustrated) . . . for temperature rise at rated current . . . and for operation under severe icing conditions. And these tests are the same as those which have proved every rating and new design in the entire Westinghouse Switch family. So whatever your disconnecting switch application may be, you can be sure of lasting dependable performance when you specify . . . Westinghouse.

Booklet B-4726 contains information on all Westinghouse Disconnecting Switches. For your copy write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60780

YOU CAN BE SURE... IF IT'S Westinghouse

WESTINGHOUSE ELECTRIC CORPORATION

EAST PITTSBURGH, PENNSYLVANIA



in the *Complete* line

Yes, it's mighty handy to open your Penn-Union Catalog and pick the exact type you need. They're all there—in a complete range of sizes; Bolted straight connectors . . . screw type . . . various split sleeve types . . . shrink fit . . . universal clamps . . . E-Z connectors with yoke and nut, etc.

The Penn-Union Catalog also gives you the *complete* line of service Connectors, Tees, Cable Taps, Grounding Connectors, Lugs, Power Connectors, etc.

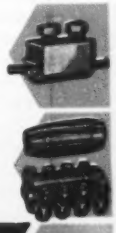
Preferred by leading users—who have found that *"Penn-Union" on a fitting is their best guarantee of unfailing service.*

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

Canada: Dominion Cutout Company, Ltd.
250 Richmond St. West, Toronto

THE *Complete* LINE OF CONDUCTOR FITTINGS

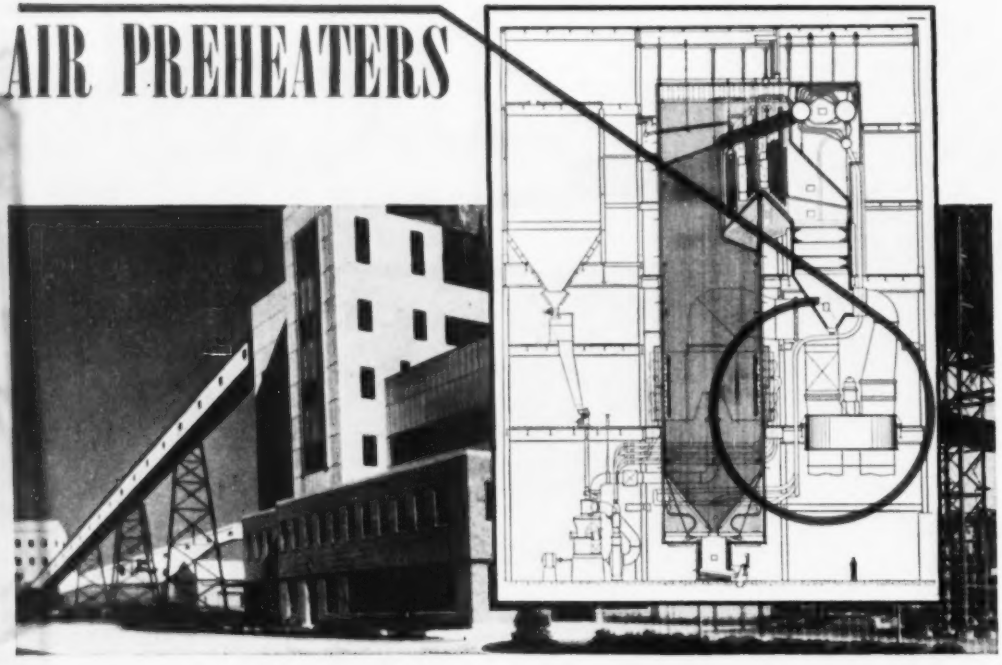


PENN-UNION

All Boilers at New Plant Yates of the Georgia Power Company

equipped with

LJUNGSTROM AIR PREHEATERS



Geared to provide increasing facilities to keep pace with Georgia's growing power demands, Georgia Power Company's new Plant Yates Station is now producing 200,000 kilowatts with a third 100,000 kilowatt unit scheduled to go in service this fall. The station was designed and engineered by Southern Services, Inc., of Birmingham.

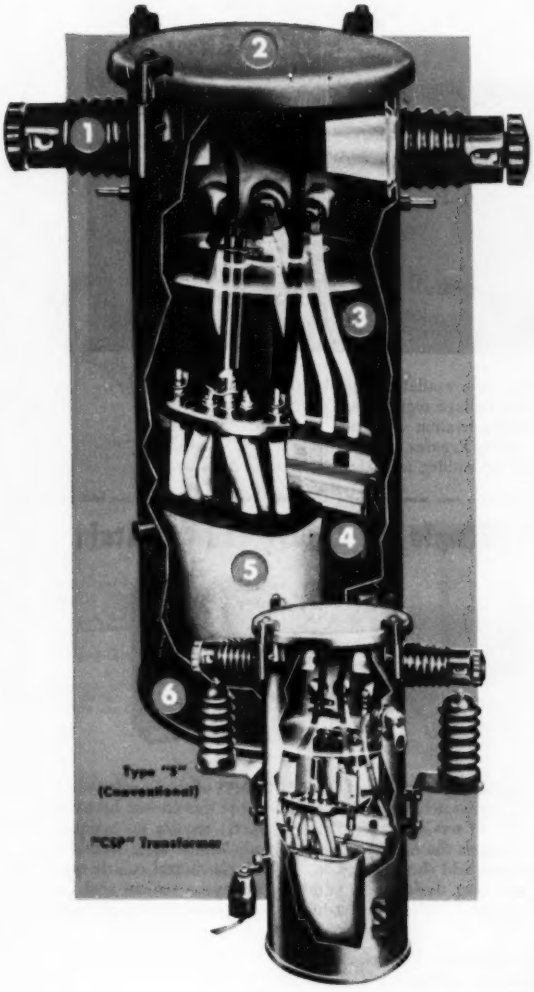
Each 100,000-kw turbine-generator in this new plant is powered by a Combustion Engineering–Superheater Steam Generator, designed for pulverized coal firing, and natural gas as an alternate fuel. Each C-E Boiler generates 975,000 pounds of steam per hour at 1325 psi and 950 F.

All of these modern steam generating units have been designed to incorporate two Ljungstrom Air Preheaters. These Ljungstroms are designed to preheat incoming combustion air to 655 F, and cool stack gases to 300 F.

Plant Yates is another example of the widespread acceptance of the Ljungstrom Air Preheater — by boiler manufacturers, consulting engineers, and utilities. Since the war, over 285,000,000 pounds of steam capacity per hour have been designed to incorporate the Ljungstrom . . . another proof that Ljungstrom Air Preheaters are standard equipment for high efficiency steam generating units.

THE Air Preheater Corporation 60 East 42nd St., New York 17, N. Y.

These Features add years of *Continuous Service!*



You can literally *haul 'em out, hang 'em up and forget 'em* . . . when you install Westinghouse Distribution Transformers, either conventional or CSP*. Six construction features, standard on all Westinghouse Distribution Transformers, make them more reliable in service . . . cut your maintenance costs.

1. Rugged High Voltage Bushings for maximum electrical and mechanical strength. Break-Proof Enrup* clamping knobs make connecting easy and safe.
2. "Coastal Finish" checks corrosion, resists moisture penetration and weathering . . . adds years to life of the tank.
3. Wemco® C-I (Inhibited) Oil . . . increases service life at least three times. Free from acids, alkali, corrosive sulphur and sludging. Staves off emulsification.
4. Hipersil® Cores . . . carry 1/3 more flux than ordinary cores. Operate with higher efficiency, lower excitation current . . . permit smaller, lighter transformers.
5. Coil assembly allows increased thermal capacity by addition of larger cooling ducts and exposure of more area to oil. Result: greater short-time overload capacities . . . better voltage regulation.
6. Sturdy tanks . . . security tested . . . positively leakproof. Double-rolled rim locks tank wall to the recessed bottom, assures rigid support.

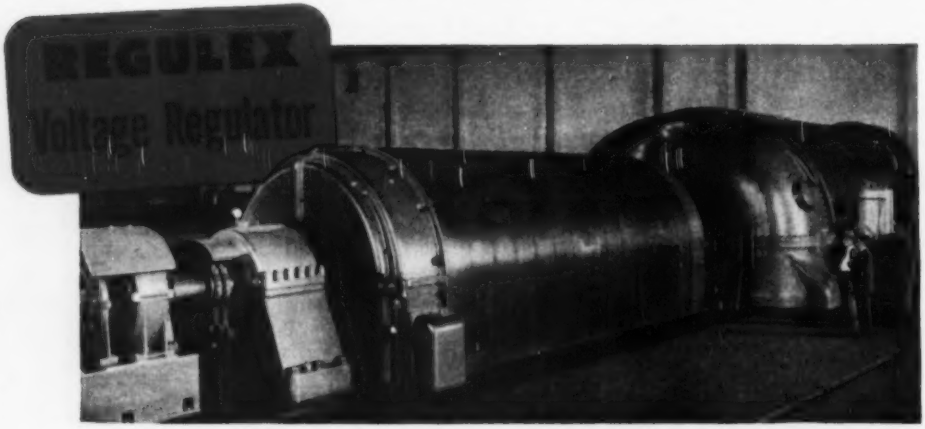
Your Westinghouse representative will be glad to give you full details on all these features. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70623

YOU CAN BE SURE...IF IT'S
Westinghouse
DISTRIBUTION TRANSFORMERS

*T. M. U. S. R. Co.

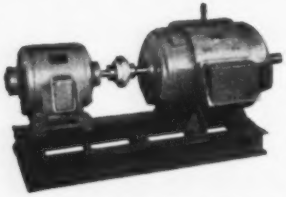
MEET NEW DEMANDS

ON OLD GENERATORS WITH



WHEN POWER DEMANDS GROW, increase your available generator capacity by increasing the safe operating limits. Install *Regulex* voltage regulators. They will automatically keep the field current high enough for stable operation — assure a safe minimum field current for any power factor load. The fast acting *Regulex* voltage regulator will also minimize the effect of system disturbances caused by sudden load changes or fault conditions.

Regulex Control is Accurate . . . Simple to Adjust and Maintain



THE MOTOR-DRIVEN *Regulex* exciter is conservatively rated for long life. Since it's similar in construction to a dc generator, the same periodic inspection routine can be followed. No special training of maintenance personnel is required.

ONLY THREE operating controls needed: (1) a control switch places regulator in and out of service; (2) a second switch controls the motor-operated main exciter field rheostat; (3) a voltage adjusting device selects proper ac regulated voltage.

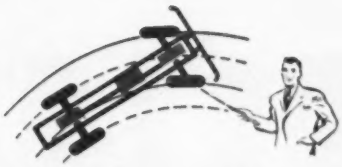
COMPONENTS of the *Regulex* voltage regulator in this cabinet have no moving parts, require no maintenance or adjustment after installation. This single control cubicle can be placed in any convenient spot or combined with switchgear equipment.

★ **You can use *Regulex* voltage regulators on alternators, synchronous condensers, and large synchronous motors. In every application, *Regulex* control gives fast response, provides accurate, sensitive voltage control. See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.**

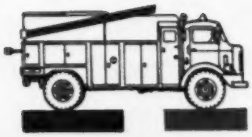
Regulex is an Allis-Chalmers trademark.

A 3770

ALLIS-CHALMERS



Fully Compensated Drive... three free-acting differentials compensate for the difference in travel of all four wheels. Reduces drive line strains, eliminates needless tire wear.

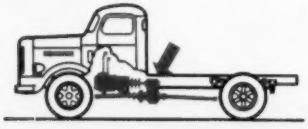


Proper Weight Distribution . . . only a true 4x4 gives you the added weight on the front wheels needed to gain the necessary traction to speed utility line work regardless of weather or terrain.

Choose FWD "Mobilized Tools"

. . . and you'll speed construction . . . improve service . . . stretch equipment dollars

Full Torque P.T.O. . . . utilizes full engine power through all transmission speeds. An exclusive safety lock prevents truck drive while boring operations are proceeding.



Two-Speed Aux. Transmission . . . doubles the number of transmission gear ratios. Provides low gear ratio for full power at extreme low speeds needed for tough, cross-country operations.

Over 78 Matched Combinations . . . Now choose the exact "mobilized tool" that meets your requirements . . . and deal with *only one* source for complete service and supply.

Faster, Safer, More Economical

FWD "mobilized tools" for line construction and maintenance were designed with the aid of utility men for utility service. This policy of *"building in"* features that you want, results in superior equipment that gets crews and tools to the job in a hurry in spite of weather, terrain, or bad footing. See your FWD Dealer to get the facts on how FWD "mobilized tools" help keep construction on schedule . . . speed service restoration . . . earn more for your equipment dollar. THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wis. — Kitchener, Ont.

Built by the makers of America's Foremost Heavy-Duty Trucks

Typical of the outstanding steam turbine generators lubricated with Gulfcrest Oil are these two 168,750 kw. Westinghouse Cross-Compound turbines at the Southwark Electric Generating Station of the Philadelphia Electric Company.

GULFCREST is the RIGHT oil for every steam turbine

the RIGHT base stock, Alchlor-processed

the RIGHT combination and concentration of additives

the RIGHT background of performance

Gulfcrest Oil has a background of successful performance in every type and make of steam turbo-generator.

In many of these installations the original charge of Gulfcrest has been in service more than 10 years with no significant change in its original characteristics, and with neutralization numbers always remarkably low and safe.

To get this kind of lubrication for your turbine, call in a Gulf Sales Engineer and ask him to recommend the proper grade of this superior oil. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation · Gulf Refining Company

Pittsburgh 30, Pennsylvania

GULF SERVES INDUSTRY

PUNTING FURTHER

FOR AN ALL-TIME COLLEGIATE FOOTBALL RECORD, ROBERT PARNHAM OF GEORGIA TECH, IN THEIR 1926 GAME WITH GEORGIA, BOOTED THE BALL 115 YARDS, WITH ROLL

JENKINS

Gold Seal Tape

GOES FURTHER, TOO...

GUARANTEED FOOTAGE
You get full measure with every roll. Tapes up tight and snug to the last inch.

NO WASTE
All Gold Seal Friction Tape tears evenly, does not ravel, molds to uneven surfaces.

HIGH DIELECTRIC
Less Gold Seal Tape needed per job. No pinholes; one tape thickness insulates.

LASTING "TACK"
Gold Seal sticks to the job under toughest conditions of cold and moisture.

EASY HANDLING
Gold Seal does not peel, dry out or smear the hands in hottest weather.

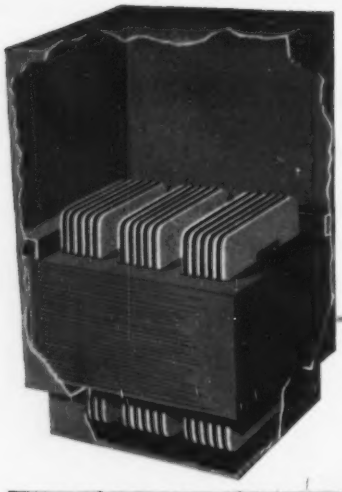
SPEEDS THE JOB
Linemen and electricians prefer Gold Seal Tape. It saves time and trouble.

IT'S YOUR BEST BUY FOR PLANT SUPPLY
Specify Gold Seal Tape and save.

FRICTION AND RUBBER TAPES
In either 10-roll cartons or single rolls. Every roll sealed in cellophane, stays fresh. Jenkins Bros., (Rubber Division), 100 Park Ave., New York 17.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM Specifications.

A PRODUCT OF JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES



This design

assures efficient cooling

The Form-Fit design of Westinghouse Power Transformers directs cooling oil to assure efficient heat transfer . . . efficiency that contributes directly to the superior operating characteristics of these transformers.

The reasons for this efficiency are based on fundamentals of transformer operation. Heat in any transformer comes from two sources: the coils and the core. The snug-fitting tank on a Form-Fit transformer directs the oil to the heat-dissipating surfaces in the quantities required. This assures maximum use of the cooling oil. The pancake-type coils, standing in a vertical plane, form natural flues for rapid circulation—on *both sides* of each coil—resulting in low temperature gradients. This provides a greater cooling margin for overloads.

Form-Fit construction is ideal, too, for forced oil cooling. Since directed oil flow is inherent in the design, no baffles or other artificial devices need be introduced.

This compact, efficient design, with the added savings in size and weight affected by Hipersil® Cores, makes Westinghouse Form-Fit Power Transformers smaller and lighter per kva than any other design. As a result, they can be shipped more completely assembled; are more economical to install. Maintenance expense, consistently, runs lower. Your Westinghouse representative will be glad to discuss the savings possible on your system, or write for Booklet B-4142A. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70639

YOU CAN BE SURE...IF IT'S
Westinghouse
POWER TRANSFORMERS

95,000 kva
3-phase, 60-cycle, FOA
132 kv to 69 kv

NOT SO MUCH AS ONE DROP IN 100,000!

De Laval Centrifugal Oil Purifiers are so efficient that De Laval guarantees that when they are operated at rated capacity they will dehydrate the insulating oil . . . down to one part water in 100,000 parts of oil. As a matter of fact, that's well on the "safe side" as guarantees go — for practical purposes De Laval centrifugal oil purifiers ***completely*** dehydrate insulating oil.

They discharge the removed water to waste after throwing it out of the oil, so there is no possibility of recontaminating the oil while in the process of purifying it.

Only one pass through a De Laval Insulating Oil Purifier is required . . . no rerunning is necessary and the filter press is not required except for the removal of colloidal carbon from circuit breaker oil.

● Ask for Bulletin TR-1.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

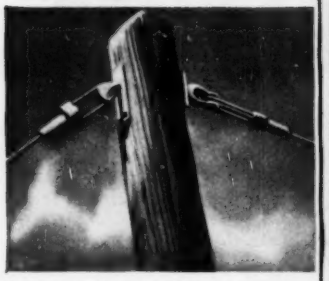
DE LAVAL

INSULATING OIL PURIFIERS

(Advertisement)

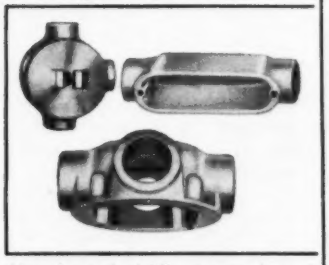
Electrical Applications of Aluminum

Stronger Splices and Deadends



Splices and deadends fabricated from aluminum tubing have proved highly successful for withstanding high pressures and heavy loads in widespread field applications. In addition to meeting the rigid strength requirements, aluminum is meeting with high favor in these electrical uses because of its corrosion resistant qualities, its workability before heat treating and its low cost. Thus aluminum has proved thoroughly satisfactory in both serviceability and in production economies. Snub-type deadends for *ACSR*, hot line clamps, tap clamps and split bolt type connectors are similar electrical applications that utilize the benefits of aluminum sheet, tubing, castings and extrusions.

Efficient Electrical Fittings and Fixtures



Many thousands of different types, sizes and shapes of die-cast aluminum electrical fittings and fixtures are in wide use today. One important reason for this popularity of aluminum is its weight. Aluminum fittings are light, easy to handle and costs less to ship and deliver to the job . . . yet are strong enough to withstand shock and strain far beyond actual job requirements. Aluminum is also rustproof and weatherproof and is highly resistant to chemical corrosion. The smooth satin finish inside and out of aluminum fittings protects fingers during installation and protects insulation on wire. Perfect uniformity in die-cast fittings and fixtures is easily obtained which makes installation easier, cuts costs and speeds up work. Write to Reynolds for details on these and any other electrical aluminum applications.

Make Important
OFFICE SAVINGS
FIELD SAVINGS
with Reynolds ACSR

Your *first* saving comes when you put through a Purchase Order for Reynolds ACSR. You'll find the original cost of this steel reinforced aluminum cable considerably less than other types of cable.

Saving number *two* comes in lower handling costs —ACSR's light weight slices dollars off freight car-to-storage-to-job-site charges.

Lower field costs give you saving number *three*. ACSR is faster, easier to string. ACSR is light yet strong—you can go to longer distances between poles—save up to four poles per mile. Or, because there is less sag to ACSR—you can use shorter poles or towers.

Figure out *your* potential savings. Then take advantage of them and specify Reynolds ACSR. Sooner or later you'll use aluminum—why not now? *Reynolds Metals Company, 2584 South Third Street, Louisville 1, Kentucky.*

FREE . . . ACSR MANUAL FOR ENGINEERS CONTAINS COMPLETE INFORMATION, CHARTS AND TABLES. Please request this booklet on your business letterhead.

NOW . . . 4 Reynolds Master Reels do the work of 100 wooden reels! Handle ACSR quicker and more economically. Eliminate reel inventory and exchange. Cut down on handling, storing, record-keeping as well as reducing damage cost to a minimum. Reynolds Master Reels and Coils are easily assembled by linemen right on the job . . . are sturdier than wooden reels.

For complete information

see your Reynolds distributors listed below or write direct to Reynolds Metals Company, 2584 South Third Street, Louisville 1, Ky.

Westinghouse Electric Supply Co., New York, New York (And branches) • North Coast Electric Co., Seattle, Washington • Griffin Manufacturing Co., Dallas, Texas • Southern Electric Supply Co., Houston, Texas • Williamson Sales Co., Shreveport, Louisiana (And branches) • California Electric Supply Corp., San Francisco, California

REYNOLDS METALS

REYNOLDS ALUMINUM

NOW...Wagner Form W offer all these features...

Preset Line To Arrester Isolating Gap

Wagner's new high voltage bushing and arrester assembly occupies minimum tank space, provides easier, safer permanent transformer connections with arresters isolated from the line.

When you choose Wagner Transformers—you get the benefit of improved design . . . better performance . . . longer life. Then, too, Wagner has a nationwide organization to provide fast, convenient service, with branches in 32 principal cities. Bulletins TU-180, TU-181 give complete information on Wagner Transformers.

Type HHH-1 Protected Transformer shown

® Wagner Electric Corporation EST. 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

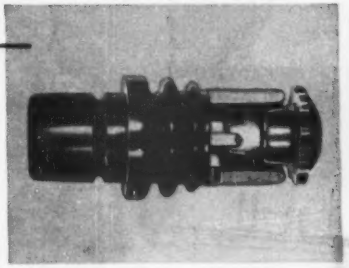
BRANCHES IN 32 PRINCIPAL CITIES

TS2 13

Distribution Transformers

1

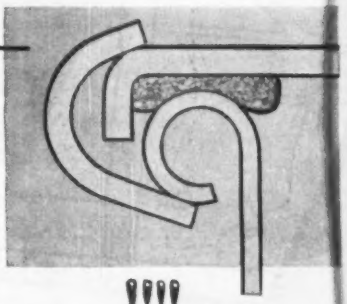
NEW HIGH VOLTAGE BUSHING



Wagner—pioneer in the use of tank wall mounted bushings—has developed a new high voltage bushing that means *faster, easier, safer* permanent transformer connections. *FASTER*—because the conductor is simply pushed in to the connector and tightened with a few turns of the knob . . . *EASIER*—no tools are needed . . . *SAFER*—the knurled knob is insulated to protect the lineman from accidental shock when tightening the terminal.

2

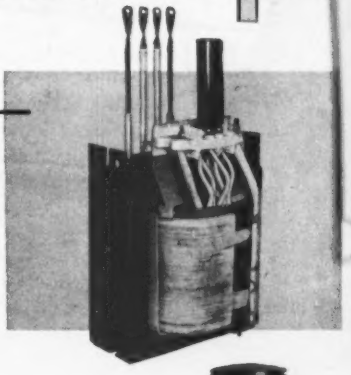
SHUR-SEAL COVER



Here's *true* sealed-tank construction! Covers are sealed to the tank with the Wagner SHUR-SEAL Clamping Ring. "Breathing" is completely prevented—no loss of oil can occur during shipment or handling. The SHUR-SEAL Ring maintains equal pressure all around the cover—yet permits easy accessibility by loosening a single corrosion-resistant bolt.

3

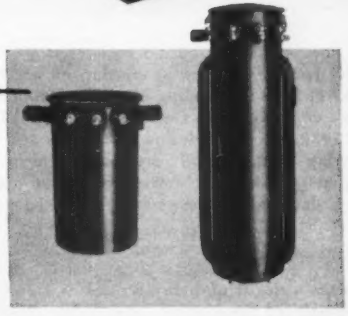
FORM W CONSTRUCTION



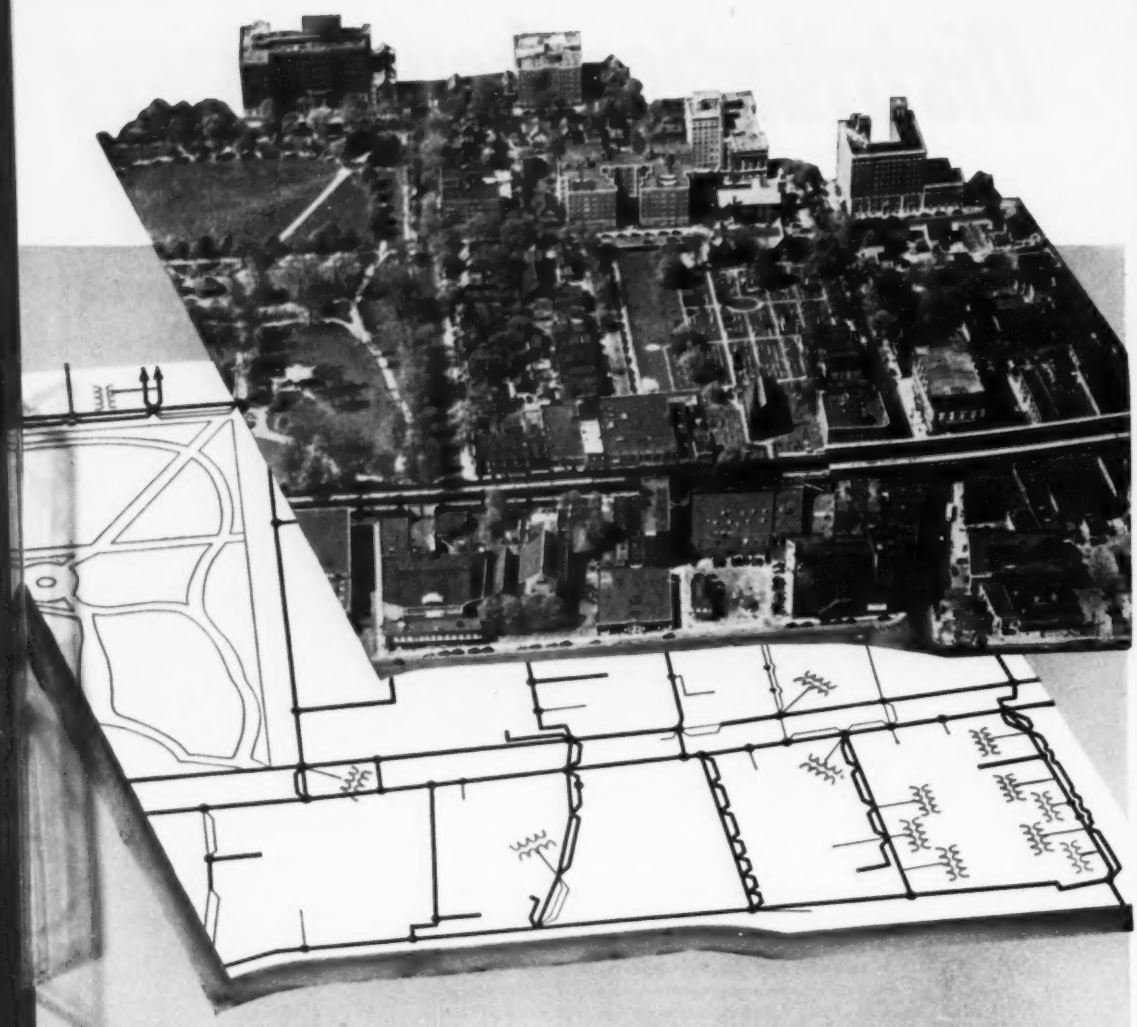
Wagner Form W Construction, with preformed cores of cold rolled, oriented grain steel, permits a liberal design in small size, light weight transformers that give excellent electrical performance. Core and copper losses are low . . . voltage regulation is good . . . exciting current is extremely low . . . and short time overload capacity is high. Form W Transformers pay dividends in longer service life.

4

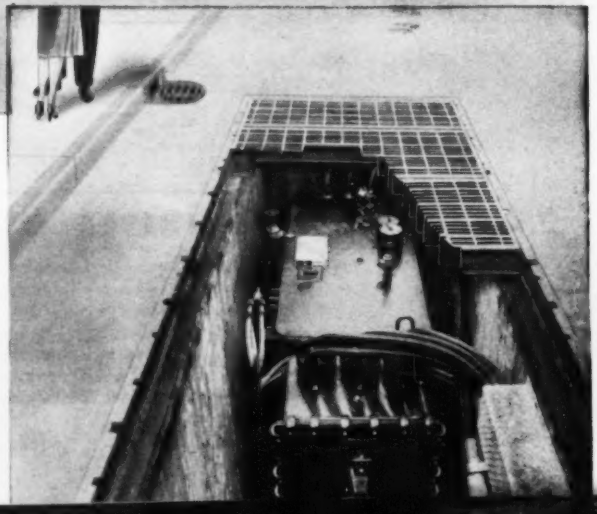
INHIBITED OIL



Wagner pole-type distribution transformers are filled with inhibited oil, thus reducing oxidation to a minimum and retarding the formation of acids and sludge which ultimately cause its deterioration. This inhibited oil, in combination with the sealed tank construction provided by the Wagner SHUR-SEAL cover clamp adds years to the servicefree life of Wagner distribution transformers.



The Jamaica network (a portion of which is pictured above) is an outstanding example of the long-run economy of networks in areas of growing load. Established in 1927, this network now consists of 258 transformers serving 120/208-volt secondaries from 27,600-volt feeders. Of the total demand of 64,000 kw, more than 35% developed in the years 1945 through 1949.



For the majority of their installations, Con Edison uses a standardized liquid-filled submersible transformer in a precast concrete vault. Readily accessible when necessary, vaults are out of the way under sidewalks or streets.

Consolidated Edison reports:

Only a Network could expand like this

In Jamaica, a section of Queens Borough, New York City, Con Edison experienced recurring load "growing pains" for years. Then in a boom of commercial remodeling, demand shot up; the problems could have become acute. In one city block, revamping and air conditioning a department store boosted demand from 570 to over 2,100 kw within three years.

But Consolidated Edison had foreseen the possibilities; had a network well established.

"The expansion was comparatively simple," they report. "No service interruption. No overtime rush. Existing facilities handled the load until new installations could be completed."

Similar situations arise continually. "Even in some suburbs," they find, "where load growth is a reasonable certainty, networks offer long-run economy."

Reliability and flexibility are the characteristics that make the change-over to network systems pay in areas where loads are growing. By practically eliminating outages, they experience fewer emergencies, avoid overtime repairs. Load problems are handled easily. And there's another all-important advantage: the value of outages avoided in dollars and in customer good will.

The reliability of modern network transformers is a vital factor in the success of any network installation. Networks make severe demands on transformer performance, particularly when secondary faults must burn clear, and when emergency overloads are carried to maintain service.

Westinghouse Engineers, working in conjunction with electric power companies, pioneered network installations and the transformers they require. Today, Westinghouse Transformers meet highest standards with features that assure trouble-free service. For specific information, ask your Westinghouse Representative for booklet B-4082A, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70627

YOU CAN BE SURE...IF IT'S

Westinghouse

NETWORK TRANSFORMERS

LAPP PORCELAIN

IS YOUR GUARANTEE

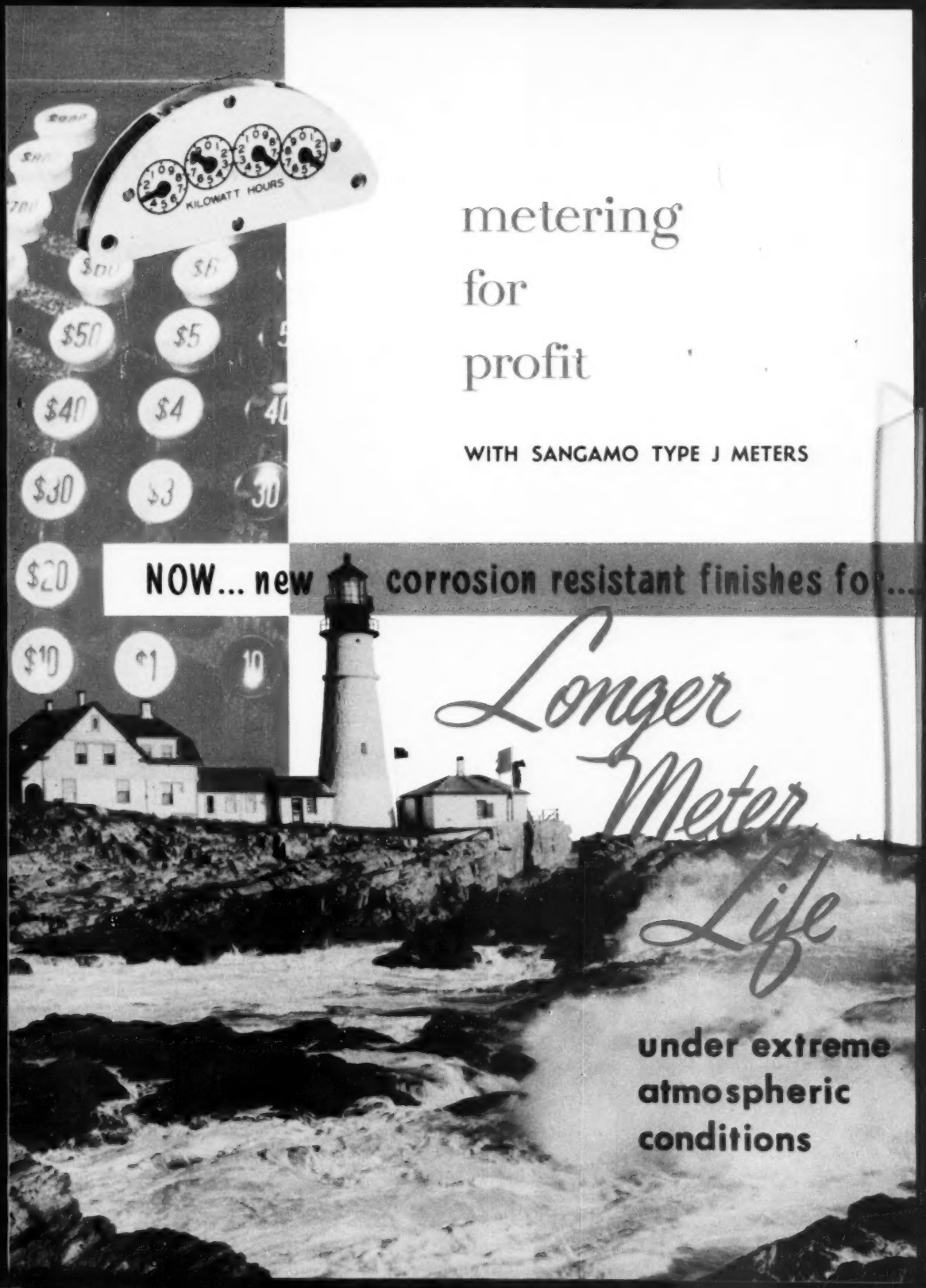
OF LONG INSULATOR LIFE

. . . when you specify LAPP SUSPENSION UNITS

Insulator life depends on soundness of porcelain, and assembly which gives it the best chance to live. For greatest insulator serviceability, look to the quality of the porcelain, and to assembly which recognizes the physical characteristics of the porcelain. Nowhere have these two requirements been the subject of more study, nor the object of more production care than at Lapp. The Lapp reputation for porcelain quality is ample basis for your confidence in the specification *"Lapp Suspension Insulators."*

Lapp

LAPP INSULATOR COMPANY, INC., LEROY, NEW YORK


KILOWATT HOURS
$50
$5
$40
$4
$30
$3
$20
$10
$1
metering
for
profit
WITH SANGAMO TYPE J METERS
NOW... new corrosion resistant finishes for...
Longer Meter Life
under extreme
atmospheric
conditions

... better performance in humid, salt-laden, or corrosive atmospheres.

Sangamo has adopted a new group of corrosion resistant finishes to protect further both external and internal meter parts from the effect of corrosive atmospheres. Now, meter life under extreme conditions of exposure is prolonged.

All aluminum, copper alloy, and ferrous parts are treated with finishes most suitable to protect them against attack from moisture and air borne organic and inorganic substances.

Tests have been made both, on completed meters, and individual parts under the salt spray conditions as defined in American Society for Testing Materials Specifications B117-49T. Seventy-two hours exposure to this spray is equivalent to many years of installation in humid, salt-laden, or corrosive atmospheres. To further accelerate deterioration, tests on meters have been made without covers.

Unretouched color photographs show the great improvement resulting from these new finishes. They also indicate the slight color changes and iridescence which result from these treatments.

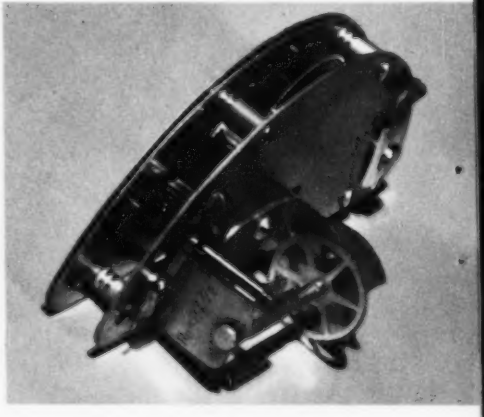
Sangamo Meters

Left view:

J Meter treated with new finishes before exposure to salt spray. Color and iridescence are due to the protective finish.

Right view:

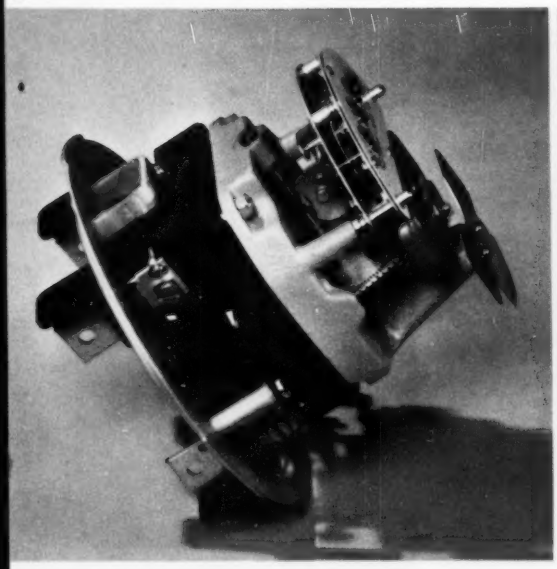
J Meter with new finishes after being subjected to salt spray. Note how functional parts are practically unaffected by this highly corrosive exposure.

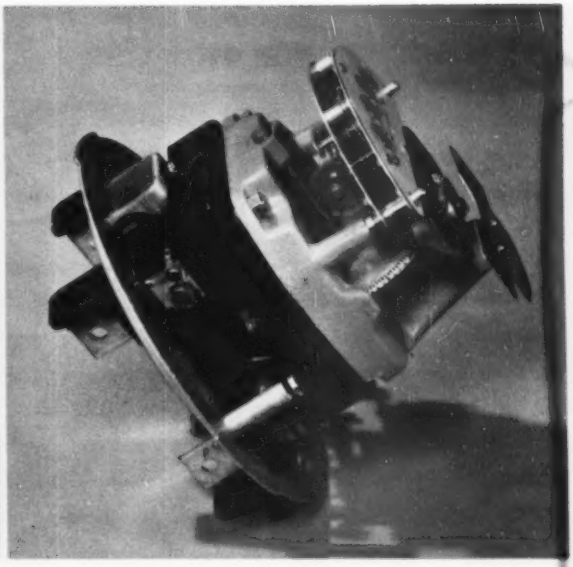


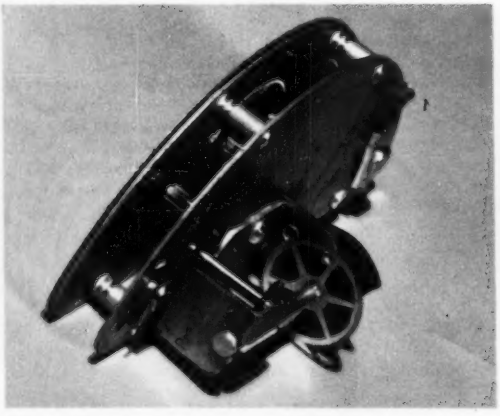
Register of J Meter with corrosion resistant finish before salt spray treatment.

proved for severe conditions of exposure...

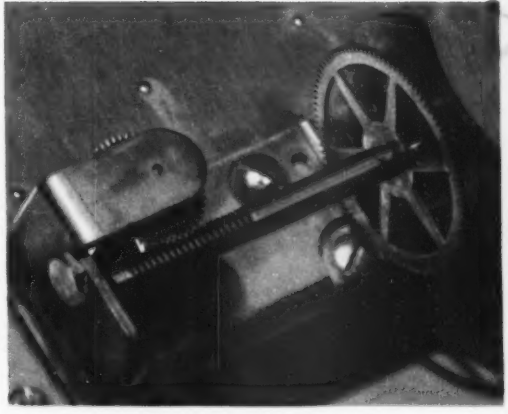
UNRETOUCHED COLOR PHOTOGRAPHS SHOW RESULTS OF 72 HOURS EXPOSURE TO STANDARD SALT SPRAY TEST.







Register of J Meter treated with new finishes after 72 hours in salt spray.



Close-up of gearing of corrosion resistant register after salt spray exposure. Little increase in register friction resulted.

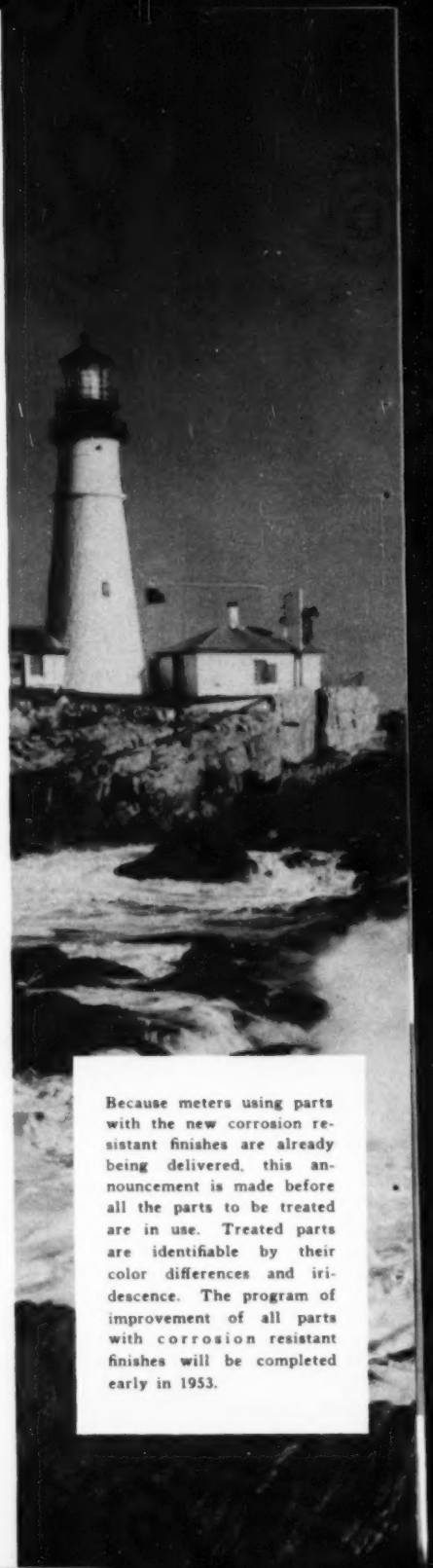
Sangamo has for years studied materials and finishes to lengthen meter life even under the most severe service conditions. New alloys and surface treatments are now incorporated in Sangamo's standard products greatly extending their useful life under extreme conditions. Rust is inhibited on ferrous parts by phosphate and organic coverings. Deterioration of aluminum is prevented by oxide films and inorganic seals. Corrosion of copper and copper alloys is minimized by the plating of dense thick layers of suitably stable metals or by inorganic films. Better resistance to the effect of corrosive atmospheres is a matter of continuous study and research at Sangamo. As new finishes become available, their applicability is determined by salt spray tests and conditions simulating severe atmospheric contamination. In addition, Sangamo is inaugurating a program of test stations on the Atlantic Coast, the Gulf Coast and the Pacific Coast, as well as in certain highly corrosive industrial areas. This is part of a continuous program of improvement. As new technologies develop they will be used by Sangamo to increase further the dependability and long life accuracy, the Utility Industry has a right to expect from the watthour meters they buy.

For more detailed information on specific aspects of this program, ask your Sangamo Representative.

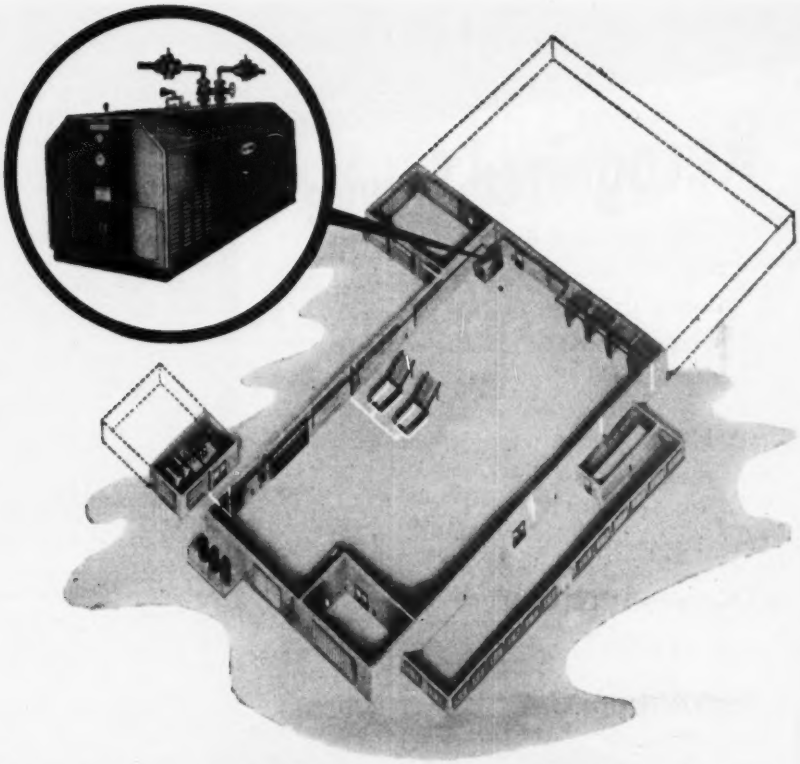
SANGAMO ELECTRIC COMPANY

Springfield, Illinois

Printed in U.S.A.



Because meters using parts with the new corrosion resistant finishes are already being delivered, this announcement is made before all the parts to be treated are in use. Treated parts are identifiable by their color differences and iridescence. The program of improvement of all parts with corrosion resistant finishes will be completed early in 1953.



EXPANSIBLE FIRESAFETY

from a single LOW PRESSURE CARBON DIOXIDE storage tank

When expanding your plant, you can't afford to wait for additional fire protection...you need the proper amount at once. However today, material priority regulations slow you up considerably...these delays hold back vital production and resulting revenue. Install a C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing System in your plant now and new construction to come will be firesafe from the start.

With a C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing System, simple piping, running from one centrally located storage tank, instantly transports clean, non-damaging, non-conducting carbon dioxide anywhere in the plant area...to flammable liquids, electrical equipment, storage spaces, manufacturing processes and record vaults. Fire at any protected location is extinguished in seconds with an absolute minimum of expense and interruption.

Future plant expansion is quickly and economically provided for by initially installing an oversized low pressure carbon dioxide storage tank...capacities range from one to fifty tons. Discharge facilities can be either manual mechanical, manual electric, automatic mechanical, automatic electric or a combination of these...all are easily extensible at a later date.

Don't take chances with future delayed installations; secure the benefits of highly efficient fire protection engineering today...our extensive experience over the years is at your disposal without obligation. Get the facts now!

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada
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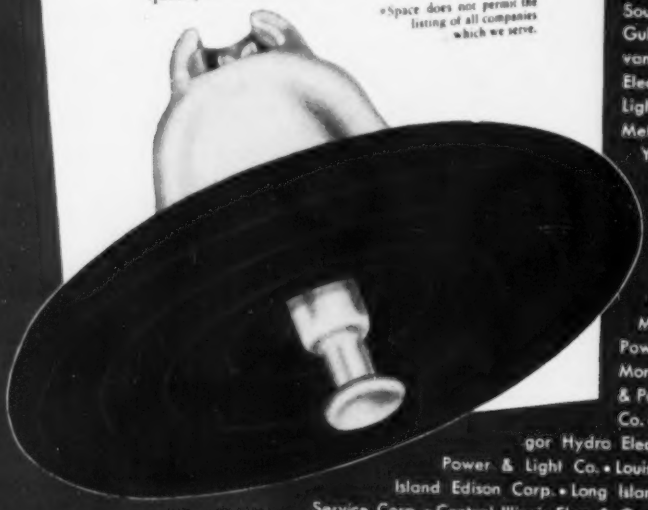
MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers • Dry Chemical Type Fire Extinguishers • Built-In Smoke and Heat Fire Detecting Systems
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems

Recognized Service

The Electric Power Industry is recognized for its unselfish service to the public and to the communities which it serves. Dependable, uninterrupted electrical service, though often taken for granted can only be sustained through eternal vigilance and a wise and critical selection of all components entering the electrical system. Porcelain Products .. proud of the part it plays in serving the Electric Power Industry through hundreds of individual power companies, many of which are recorded here*—dedicates itself to supplying the Industry with quality insulators and accessories at all times.

*Space does not permit the listing of all companies which we serve.



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A COMPLETE LINE OF TRANSMISSION AND DISTRIBUTION INSULATORS AND ACCESSORIES FOR ELECTRIC UTILITIES

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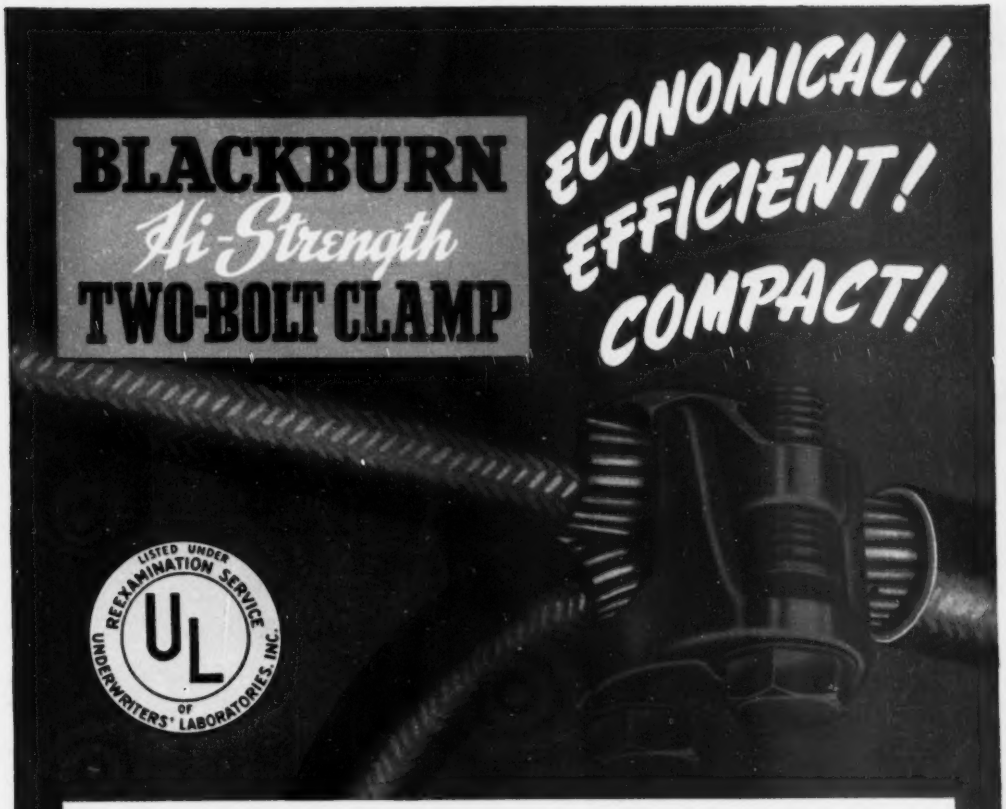
Porcelain Products, Inc.

BLACKBURN *Hi-Strength* TWO-BOLT CLAMP

ECONOMICAL! EFFICIENT! COMPACT!



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A BETTER CABLE CONNECTOR AT LESS COST!

- Especially designed for medium and large stranded wire and cable.
- Produces very high clamping pressure resulting in low resistance joints on stranded wire.
- It costs much less than other types of connectors commonly used.
- It is excellent for dead ends, taps, and service entrance connections and will accommodate a range of wire sizes.
- Exclusive helical serrations in both body and cap, conforming to the lay of stranded wire, together with the high clamping pressure produce a joint which will not pull apart. Thus the Blackburn Two-Bolt CLAMP is excellent for dead ending.
- It's made of high strength alloys throughout. Its extra strength maintains the high "pressure between wires" indefinitely. Thus it makes a lasting, trouble-free connection.
- It's compact and easy to tape — makes a neat joint.
- It's simple and easy to install.
- Made in sizes 1/0 to 1000 MCM.

Jasper Blackburn Corporation

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Mail Coupon for Sample and Full Details

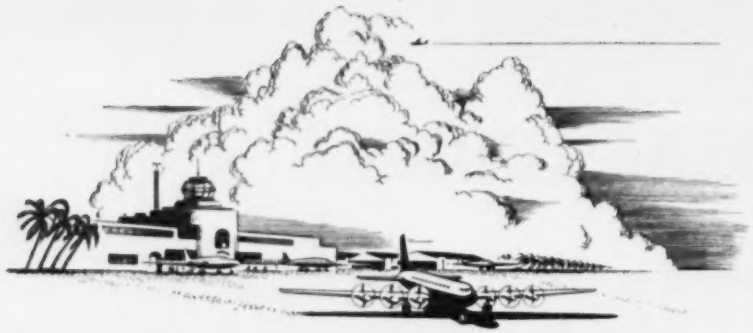
Send me sample and further information on the BLACKBURN TWO-BOLT CLAMP.

Wire Size Used_____

Your Name_____

Company_____

City & State_____ EW



Dependable Insulation "upstairs and down"

BH "1151"

Fiberglas
Silicone Rubber
Tubing . . . Sleeving

Often in a matter of minutes a plane wings from a steaming tropic air-strip to the sub-arctic temperatures of the stratosphere. Fungus breeding, wet heat one minute . . . intense, stiffening cold the next . . . and the electrical system must "take it".

That's why BH "1151" was developed. Here at last is electrical tubing and sleeving of braided Fiberglas coated with Silicone Rubber that is *inherently* flexible — no plasticizers or solvents to "sweat out" — and chemically incapable of supporting fungus growth.

BH "1151" is the new Class H insulation that is completely flexible when manufactured and *keeps* that flexibility

BH "1151" withstands bending, required in normal assembly, without loss of dielectric strength — will not craze or crack. Remains unchanged through continuous operation at temperatures from –90°F. to 400°F.

The flexibility of BH "1151" speeds installation and offers new design freedom while assuring product protection.

Bring your product up to date — insulate it with BH "1151" Tubing and Sleeving. Write for samples and data sheets today.

Address Dept. W-12

BENTLEY, HARRIS MANUFACTURING CO.
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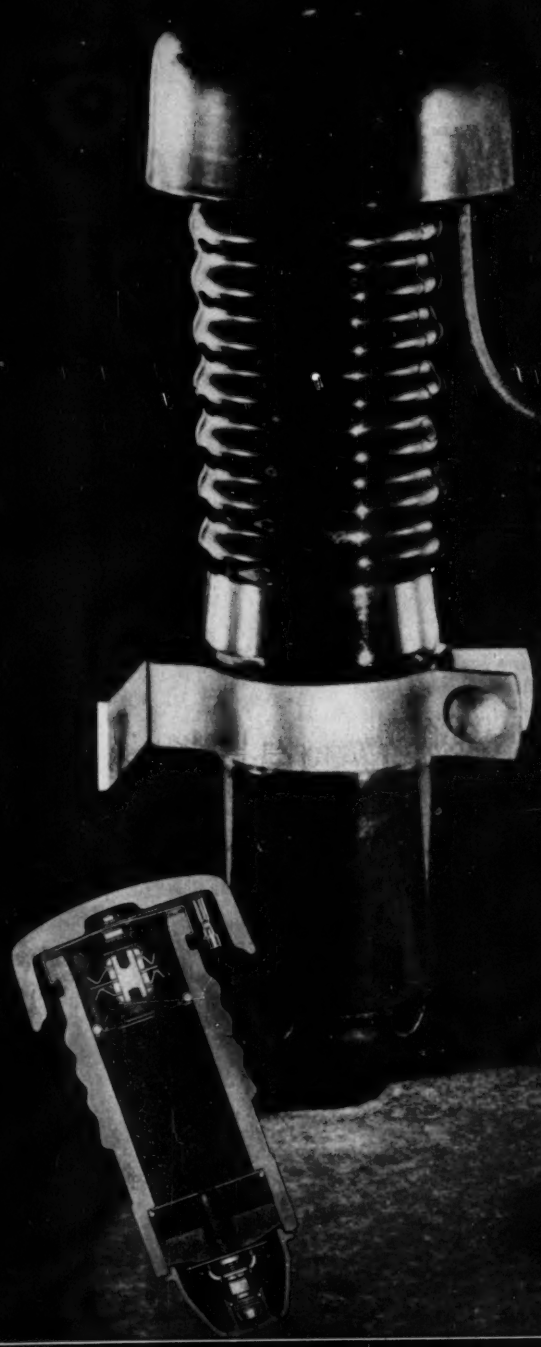
BH *Fiberglas** SLEEVINGS

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393590). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.



THE ARRESTER WITH A *Heart* OF TRUE PROTECTION

Crystal Valve Element Guards Equipment, Service

Oxidized silicon carbide grain—heart of every Crystal Valve Lightning Arrester—is the exclusive secret of its dependable two-way protection.

At normal voltages, this amazing element has very high resistance. But under a lightning surge, resistance drops to a mere fraction of normal, returning high again when the surge is passed. Result—full protection for transformer insulation, plus no service blackout.

Non-deteriorating, this Crystal Valve element assures long-lasting, efficient, dependable protection. Its automatic adjustment to the severity of the discharge means minimum IR voltage drop and ample surge voltage reduction. You can rely on Crystal Valve Arresters—both ways!

Write Dept. 1709 today for latest data on lightning arresters. Ask for CV catalog. No obligation.

ELECTRIC SERVICE MANUFACTURING CO., PHILADELPHIA 32, PA.

CRYSTAL VALVE LIGHTNING ARRESTERS

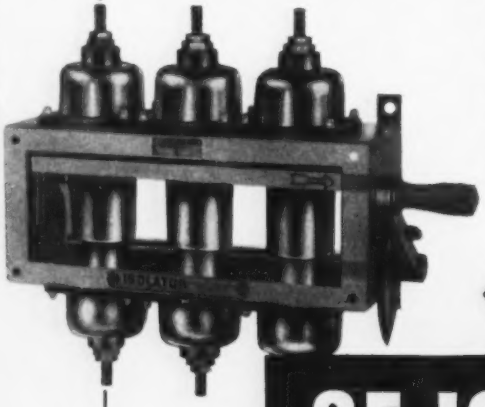
the STRAIGHT LINE disconnect

SAVES SPACE AND MATERIAL

The ISOLATOR'S straight line telescoping action performs disconnect operations using no more space when open than when closed. The insulator bushings also telescope effectively shielding live parts and eliminating the need for additional flash barriers. The ISOLATOR occupies about ⅓ the space needed for a comparable blade type switch and as it uses less space a smaller enclosure can be used if needed.

GIVES EXTRA MARGIN OF SAFETY

Current carrying parts are recessed within the upper and middle bushings. When ISOLATOR is open a full open gap is provided between live parts. The clearance between these bushings, however, is narrow, preventing accidental contact but at the same time giving visible evidence that device is open. The exposed upper and lower studs are arranged for easy taping. These features insure a definite superiority in safety. A man working in an ISOLATOR equipped cubicle has complete freedom from live part hazards.



3-P.S.T. 400 ampere 5000 volt ISOLATOR

167 DIFFERENT ISOLATOR UNITS ARE AVAILABLE

ISOLATORS are made in one, two, three and four pole units to 15000 volts and to 2000 amperes... factory assembled to meet your requirements.

FOR FULL DATA
WRITE FOR BULLETIN 140

3E ISOLATORS

THREE E

ELECTRICAL ENGINEERS EQUIPMENT CO. MELROSE PARK, ILLINOIS

Monsanto Penta plays part in happy landings

MONSANTO PENTA protects wood in the towers of Love Field's new approach light lane.

A new, high-intensity approach light lane, to guide planes to happy landings, is in service at Love Field, Dallas, Texas. Supporting poles, H-frames and platforms are protected by Monsanto Penta to give them longer life.

In the 2,420-foot approach lane are 21 towers, 35 to 65 feet high, each constructed of two poles topped with a platform supported by H-frames. Some of the poles are set in Bachman Lake and will stand in water constantly. Poles, platforms and frames are southern yellow pine. All are protected by Monsanto Penta, applied by pressure to a minimum net retention of 8 # penta-in-oil solution per cubic foot of wood. The preservative was applied for the Civil Aeronautics Administration by Standard Wood Preservers of Shreveport, Inc., Shreveport, Louisiana.

Monsanto Penta (pentachlorophenol) is a stable chemical made for wood preservation. It protects against decay . . . against termites and other wood-boring insects. It does not leach. Rain and ground water cannot wash it away. Penta treatments can be designed to make wood moisture-repellent and to leave surfaces clean and paintable.

FOR INFORMATION *on the use of Monsanto Penta, contact the nearest Monsanto Sales Office. Write for a copy of Monsanto's new booklet,* "For Maximum Wood Protection, Specify Monsanto Penta." MONSANTO CHEMICAL COMPANY, *Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.*

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PENTA

MONSANTO
CHEMICALS – PLASTICS

Serving Industry . . . Which Serves Mankind

somewhere in your building,
lurking like a cat....
fire is ready to pounce.
In flammable liquids,
electrical equipment, record
vaults. Your surest protection
is a Kidde Fully Automatic
CO_2 Fire Extinguishing System.

Kidde

quick as a mouse, check the "Yellow Pages" for your KIDDE dealer

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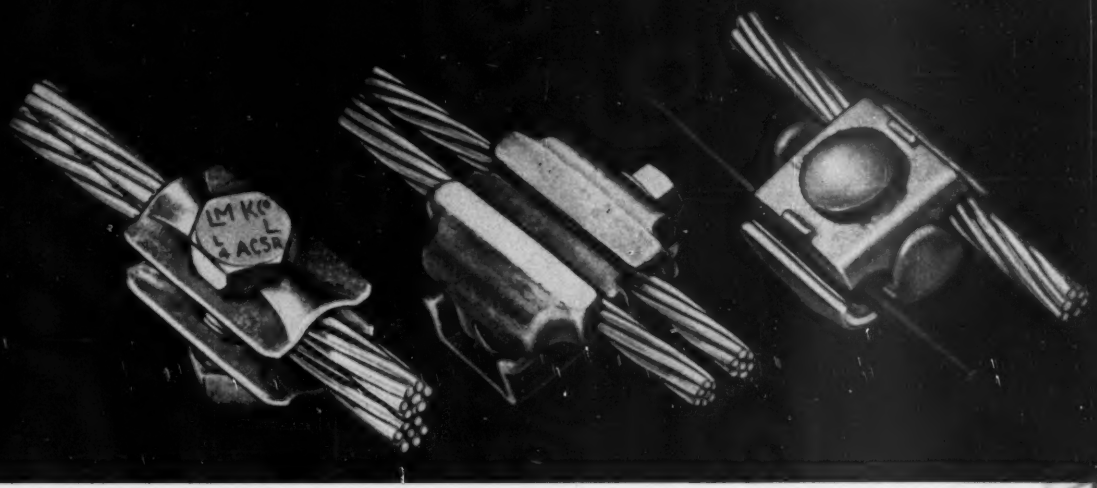


ONLY L-M Offers All 3 Types of Connectors for Aluminum

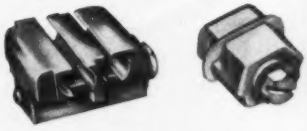
1–SPLIT BOLT

For Al to Al: Type AA, left, is plated bronze with two aluminum washers. For #2 to 4/0 solid; #4 to 4/0 ACSR. Type PB, right, is a plated bronze connector with plated spacer bar. Sizes from #2 to 4/0 solid aluminum; #4 to 4/0 ACSR.

For Al to Cu: Type AC, left, is plated bronze with one aluminum and one bimetal washer. Five sizes, for #2 and 1 solid, #4 to 4/0 ACSR, and #2 to 4/0 solid copper or #3 to 4/0 stranded copper. Type CA, right, has a bronze body with two bimetal washers. In a full range of sizes from #6 solid aluminum to #4/0 ACSR, and #6 solid copper to #4/0 solid or stranded.

L-M Split Bolt and Fargo Vise-Type Connectors fully meet new standards of the Electrical Service Connector Institute.

2–VISE TYPE



For Al to Al: The famous Fargo vise-type connectors provide wide contact surfaces and massive design for greater heat dissipation; always threaded; no loose parts. At left, No. 9000-3, for sizes up to and including 397,500 Al; No. 9000-1, right, for #4 ACSR and smaller.

For Al to Cu: The vise-type principle in cast alloy with bimetal inserts, for aluminum to copper connections. No. 9000-4 at left is for sizes up to and including 397,500 Al. No. 9000-2 at right is for #4 ACSR and smaller.

3–CLAMP TYPE

For Al to Al: One-Bolt Parallel Groove Clamp, No. CL10X, for Al to Al connections. Clamp casting is aluminum, with galvanized steel square shank bolt, washer, and nut. For ACSR #6 to 4/0, #4 to 1/0 armored.

For Al to Cu: One-Bolt Parallel Groove Clamp, No. CL10X, same as above, except that copper liners are brazed to aluminum body on tap side. For copper taps #12 to 2/0. Also in all bronze for copper-to-copper connections.

Ask L-M's Connector Headquarters for Information

Years of research and development by L-M Engineers assure the best connectors and a full range of types for aluminum, copper, and combinations. See the L-M Field Engineer or write for bulletin. Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division).

LINE MATERIAL *Connectors*

Complete Coordinated Equipment for Distribution Today

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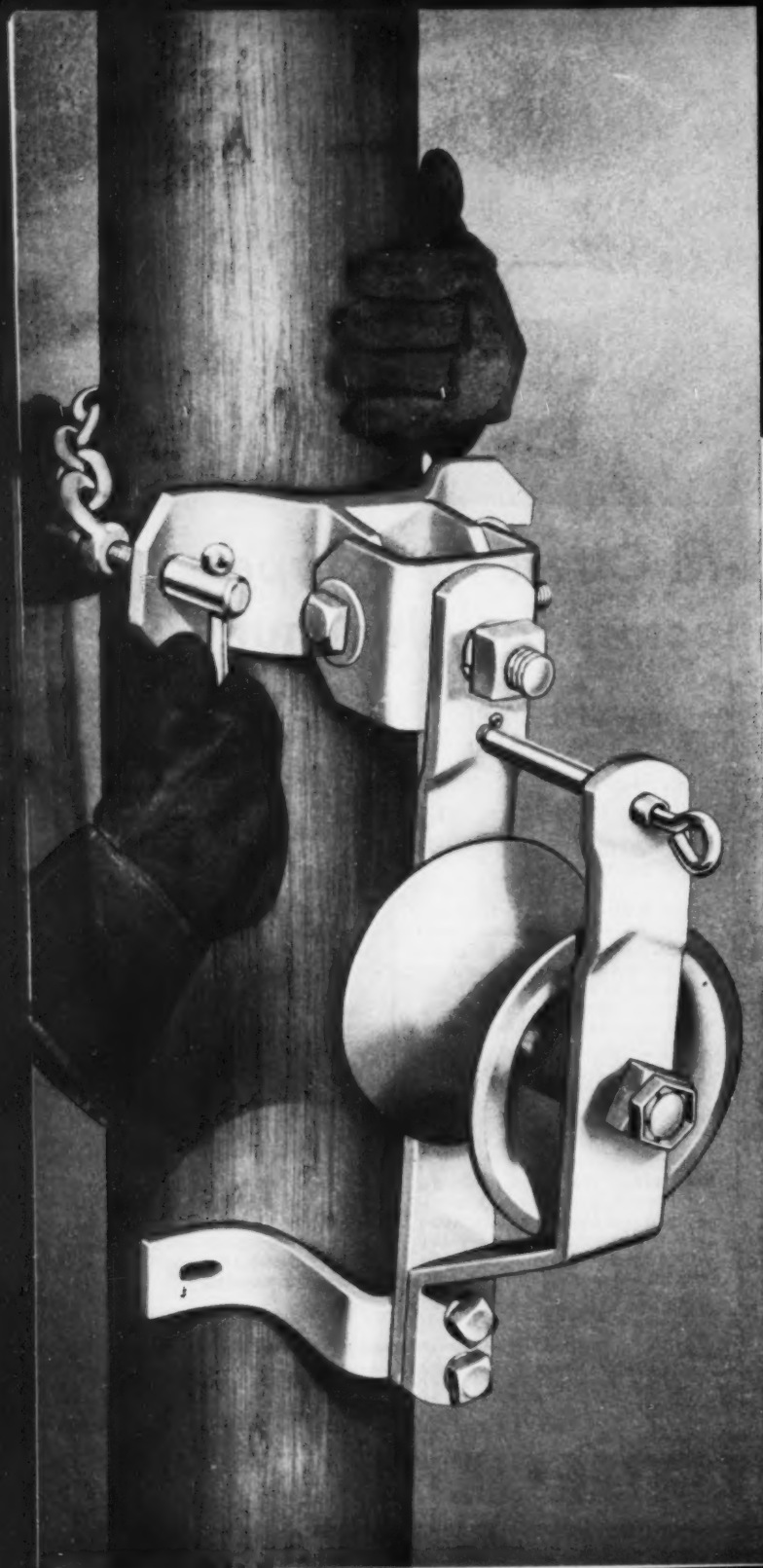
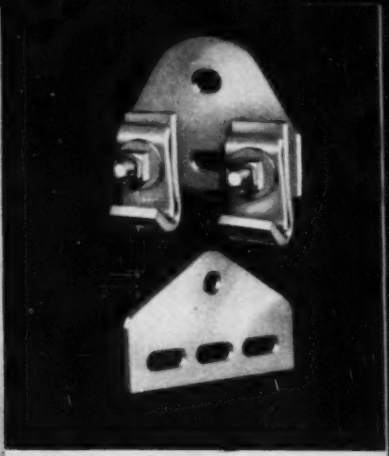
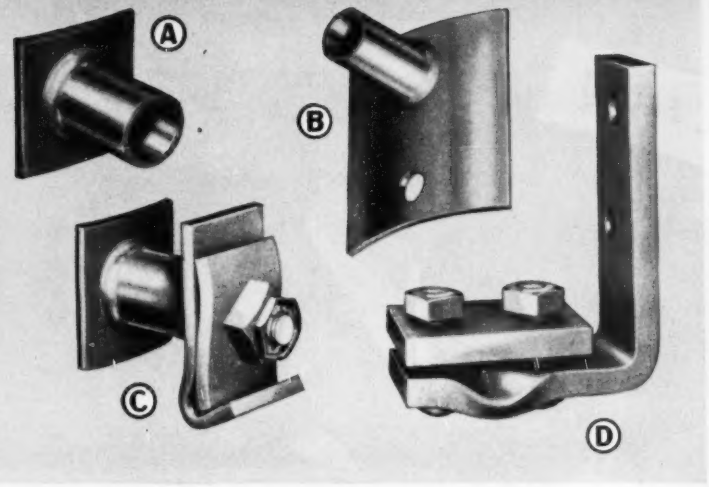




DOUBLE SUSPENSION HANGER clamps the messenger and may be used during stringing without tightening the clamps. The lower plate takes two or three one-bolt clamps. May be mounted as a unit with a machine bolt and washer spacer, or hung on the swinging bracket.

HINGED STRINGING PULLEY needed at each pole for economical, safe installation of aerial cable without damage to conductor insulation. Used on both tangents and angles, mounted just below the permanent messenger clamps, and removed after line is strung. Hinged joint between pulley yoke and pole frame permits pulley to swing out, keeping cable in the groove.

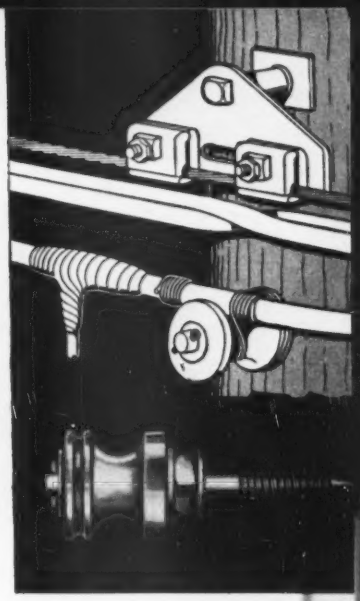
DOUBLE-SWING SUSPENSION BRACKETS made by combining standard parts. Below is the complete bracket; bottom illustration shows another type of hanger that may be substituted. Meets unusually severe conditions, where a free-floating bracket is needed. Assists in equalizing stresses on cable. Malleable pole plate is curved, to give extra rigid support; mounted with one machine bolt and two lag screws.



WASHER SPACERS used where standard machine bolts are used to mount messenger clamps. These spacers provide good bearing on the pole and keep cable from rubbing against the wood. Top left (A) is Flat Washer Spacer; at right (B) is Curved Plate Spacer for heavier cables, or longer spans; lag screw in lower hole keeps machine bolt from ovalizing hole in pole.

ONE-BOLT HANGER (C) shown with small washer spacer, used for small aerial cables such as street lighting and secondary cable. Rounded groove, flared edge. For ½" or ⅝" bolt.

UNIVERSAL MESSENGER HANGER (D) used for smaller size cable or where minimum clearance between cable and pole is required. Rounded groove has widely flared edges to prevent nicking the strand as well as to permit using this hanger on small angles as well as tangents. Forged open-hearth steel, hot-dip galvanized. Widths from pole 3⅜" and 4 3/16", and 4⅛" high, with offset holes for ⅝" machine bolt and ½" lag screw. Two ½" track bolts. For messenger from ¼" to 9/16".



INSULATED LAG SCREW BRACKET used to support the phase conductor where the conductor has been taken out of assembly—for example, when making a transformer tap. Standard ½" x 3" gimlet lag screw, with head and extension for a 3" dry or wet process spool insulator.

L-M Offers Service-Tested Materials to Simplify Aerial Cable Construction

DOUBLE UPSET EXTENSION BOLT provides, in one piece, a mounting bolt, spacer for pole clearance, and extension for mounting clamps. Eliminates stocking and assembly of separate parts, and thus saves more in time than it costs. Strong hexagonal section provides wrench hold. One-piece mild steel forging, ⅝" diameter, 6 to 18" long plus 4-inch extension.

To meet the special requirements of aerial power cable, Line Material some years ago began to study the needs for construction materials. The engineers, working alongside of the utility company specialists, soon found that standard pole line hardware was seldom completely satisfactory. And so a program of designing and testing special hardware was instituted. This program has continued, and as new requirements appear, new items are developed and tested.

L-M aerial cable construction materials are designed for maximum utility and interchangeability. These items can be fitted together in a variety of combinations to serve a number of purposes. The result is that with L-M aerial cable construction materials, you can solve almost any construction problem, regular or special, that may be encountered.

For help on any problem

Ask the L-M Field Engineer for information on the complete line of L-M aerial cable hardware, and a copy of Bulletin AC1; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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LINE MATERIAL

Line Construction Materials

Complete Coordinated Equipment for Distribution Today

FIGURE 1—Earl J. Kirsch, Assistant Manager, Transformer sales, exhibits the L-M Round-Wound core-coil assembly, which provides an almost ideal magnetic circuit. The wound core has no air gaps; has stable characteristics, low exciting current. Long round coils wound directly onto the core encircle a large part of the core, making possible fewer winding turns and lower copper loss.

FIGURE 2—Core is tightly wound, under tension, of continuous strip of oriented silicon steel, of varying widths to provide a core of nearly round cruciform cross section.

FIGURE 3—The cross section of the wound core is cruciform, closely approximating a round form.

FIGURE 4—After the core is annealed, coils are wound directly on the uncut core, by means of split winding flanges driven by gears on the L-M exclusive winding machine.

How L-M Round-Wound Design Cuts Losses in Distribution Transformers

by **James G. Everhart**, Chief Engineer, Transformer Division, Line Material Company

Utility companies are under terrific pressure today between higher costs and higher taxes on the one hand, and lagging revenues on the other hand. Today, as never before, power must be distributed with the utmost economy, and great attention is being devoted to the reduction of every possible loss.

Transformer losses are one factor that is receiving extensive study, by both the operating companies and the manufacturers.

In this economy drive, transformer loading is also receiving major attention, with a view to maximum utilization of equipment—and this introduces another factor into the study of losses.

The Battle for Savings

The ratio of losses of a distribution transformer affects overload capacity. The copper loss watts vary as the square of the overload. In comparing two transformers of identical physical proportions including coil cooling surface exposed to oil, it is obvious that the unit with higher copper loss has less overload capacity before damaging temperatures are reached than does the transformer with lower copper loss. This effect is further emphasized by the fact the high copper loss dictates a small unit with less surface.

Core loss, on the other hand, is something the utility company pays for 24 hours a day. Therefore the designer must take both core and copper losses into account in providing the best possible balance of performance characteristics.

Exciting current, another factor in operating cost, is deserving of attention, and should be reduced to whatever extent can be done by a design that does not at the same time sacrifice other performance characteristics.

"Balanced Performance"

To meet these considerations, transformer design must essentially be a series of compromises. The L-M Round-Wound transformer consists of a wound core, with long round coils wound directly onto the core (Figure 1). This construction offers certain inherent advantages which make it possible for L-M designers to minimize compromises and offer *balanced performance*.

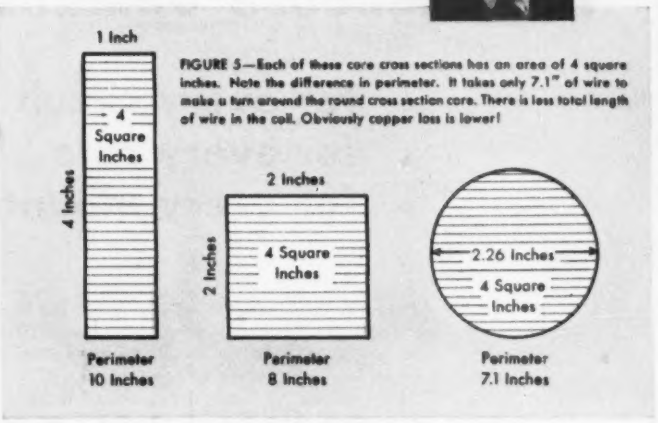

FIGURE 5—Each of these core cross sections has an area of 4 square inches. Note the difference in perimeter. It takes only 7.1" of wire to make a turn around the round cross section core. There is less total length of wire in the coil. Obviously copper loss is lower!

Wound Core Is Not Cut

First of these inherent advantages is the exclusive L-M wound core itself. It is tightly wound of continuous strip of cold rolled oriented silicon steel, with no cuts, laps, or gaps (Figure 2). This superior core makes possible the higher overload capacity and balanced losses of the Round-Wound transformer.

Lower Exciting Current

Since the core is not cut, no air gaps are created which would break up the flux path and produce higher exciting current, with consequent loss in revenue.

Low Core Loss

The higher magnetic efficiency of this core makes it possible to achieve low core loss easily, while the core at the same time contributes greatly to balanced performance. Incidentally, this continuous core is also far more quiet than one which contains air gaps.

Another advantage of the L-M wound core lies in the fact that the cross section is cruciform, approaching the round (Figure 3). Round coils are wound directly onto the core in an L-M designed winding machine (Figure 4). As shown in Figure 5, these coils allow a reduction in the perimeter of the coil and permit more efficient utilization of the copper. With the same cross section wire, and the same number of turns, there is less total length of wire, and less watts of copper loss. This is one of the inherent advantages of the L-M wound core that gives the designer more leeway in achieving a proper balance of performance characteristics.

Detailed typical performance characteristics of Round-Wound transformers are available from the L-M Field Engineer, or by writing Mr. Everhart at the Transformer Division, Line Material Company, Zanesville, Ohio (a McGraw Electric Company Division).

"Round-Wound" is a Line Material Co. trademark.

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LINE MATERIAL Transformers

Complete Coordinated Equipment for Distribution Today

There's a *Low Cost* Westinghouse Demand Meter...

- **for every circuit**
- **for every rate**
- **for every mounting!**

Here are the answers to all your needs for less costly metering of kw and kva demand. It's a *complete* line of Westinghouse Demand Meters, engineered specifically to shave your specialized metering costs. In every case the designs are . . .

Simple . . . only a minimum number of moving parts. Block Interval types are used with standard Westinghouse Meters. Thermal demand elements are combined with conventional watthour meters.

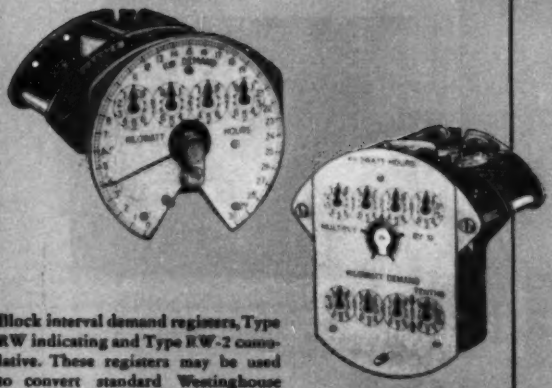
Compact . . . no larger than a 3-element watthour meter except for increased depth.

Easy to install . . . just one mounting for both watthour and demand meter . . . connections are interchangeable with standard watthour meters.

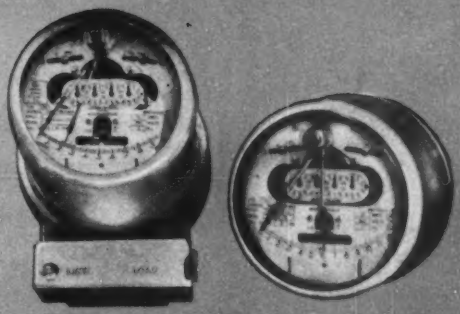
Easy to maintain . . . in all units you'll find the same low maintenance characteristics you enjoy in Westinghouse Standard Watthour Meters.

Specific examples of Westinghouse pioneering in pace with your needs include: the first polyphase, combination thermal unit in a socket base; the first and only combination polyphase watthour and thermal kva demand meter.

It is the kind of skillful, pace-setting engineering that stands behind every meter that Westinghouse builds today. It's another good reason to always specify . . . Westinghouse. J-40425

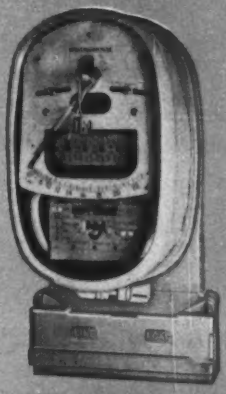


Block interval demand registers, Type RW indicating and Type RW-2 cumulative. These registers may be used to convert standard Westinghouse Watthour Meters to demand types.



CAH and CSH single-phase, combination watthour and thermal demand meters. In the Type CSH a 50-ampere meter with 48-kw (200-amp) full-scale rating is available.

CSH and CAH polyphase, combination watthour and thermal demand meters. CSH-8 is the first polyphase meter available for socket mounting.



KCA polyphase, combination watthour and thermal kva demand meters . . . available for all services under all conditions of current, voltage and power factor.

QCS and QCA single or polyphase, combination watthour and thermal ampere demand meters . . . available in all standard ratings.

GET COMPLETE INFORMATION...

Complete details, including operating and construction features, application information and wiring diagrams, are contained in individual catalogs covering each of the meters shown here. Ask your Westinghouse representative for copies or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

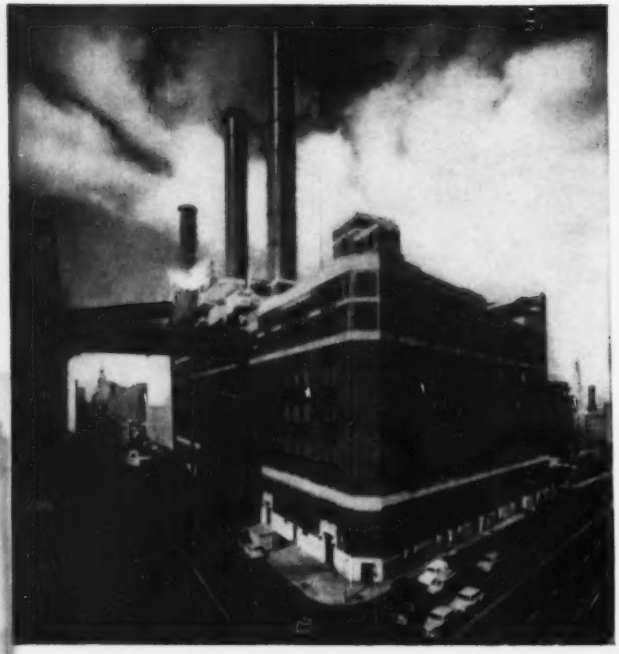
Type RW (Indicating) Demand Registers . . . C.S. 42-313

Type RW-2 (Cumulative) Demand Registers . . C.S. 42-316

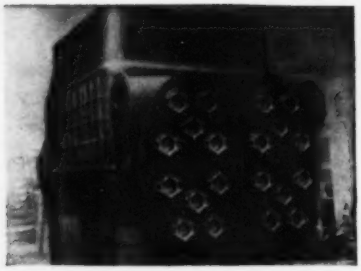
Type CSH and CAH (single-phase) Combination kw Demand . . . . . C.S. 42-337

Type CSH and CAH (Polyphase) Combination kw Demand . . . . . C.S. 42-338

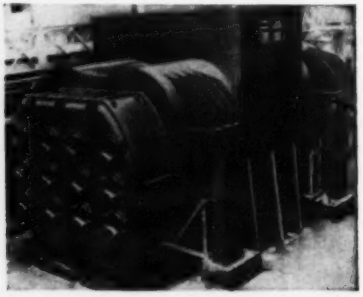
Type KCA Combination kva Demand . . . C.S. 42-349



CON EDISON'S EAST RIVER ELECTRIC GENERATING STATION at 14th Street, New York City, will contain the new Worthington 125,000 sq-ft condenser. The shell, which is to be installed under 160,000-kw Unit No. 7, will contain nearly 105 miles of ¾" O.D. aluminum brass tubes and will require 138,000 gpm of East River water supplied by two 54 in. Worthington "Mixflo" vertical single suction volute circulating pumps.



WORTHINGTON CONDENSER installed in 1931 to serve 160,000-kw Unit No. 7, Hudson Avenue Station. Tube sheets were drilled for 110,000 sq ft with 101,000 sq ft installed.



ONE OF TWO 74,500 SQ-FT 2-PASS WORTHINGTON CONDENSERS serving 60,000-kw Units 14 and 15 at Waterside Station No. 1.

Con Edison once again installs "largest" condenser

On several occasions over the past fifty years, Worthington has been selected to build the "world's largest" surface condensers in single shell design.

In 1919, a 70,000 sq-ft condenser was installed under a 35,000-kw turbine-generator for a prominent utility company. This was the largest single shell surface condenser of its day.

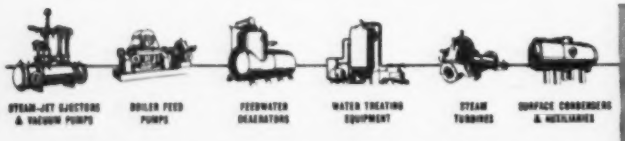
In 1931, Brooklyn Edison Company (now Consolidated Edison Company of New York, Inc.) installed, under 160,000-kw Unit No. 7 at the Hudson Avenue Station, the "world's largest" at that time, a 101,000 sq-ft single-pass Worthington condenser. This was followed, in 1949, by two 74,500 sq-ft condensers for Waterside Station No. 1.

Now, Worthington is again building for Con Edison the "world's largest" single-shell condenser ever ordered, 125,000 sq-ft, single-pass, for the 160,000-kw Unit No. 7 addition to East River Station.

Worthington, with over a century of experience in the manufacture of steam power equipment, is prepared to build efficient condensers in all sizes. Let us advise you, without obligation, on your new installation.

Write, stating requirements, to *Worthington Corporation, Steam Power Division, Harrison, New Jersey.*

Z.2.2



World's Broadest Line of Steam Power Plant Auxiliaries

WORTHINGTON

Condensers

F. R. "MAC" McVICKER OF ST. LOUIS welcomes the friendly "SHOW ME" attitude of utility folks he calls upon in Missouri and neighboring states of Indiana, Illinois and Arkansas. "My utility friends always give me a good chance to talk up the many good points of Locke insulators," reports "Mac", "but sooner or later they say 'SHOW ME' proof of what you say. This, of course, gives me a fine opportunity to show some of the wonderful service records established by Locke insulators in this area, as well as in other sections of the country. These service records always impress because they're so outstanding. Service records like these are another one of many good reasons why leading utilities put their confidence in Locke insulators."

In St. Louis, "Mac" McVicker says —

"UNION ELECTRIC COMPANY OF MISSOURI SERVICE RECORDS REVEAL WHY LEADING UTILITIES PUT THEIR CONFIDENCE IN

LOCKE SWITCH INSULATORS"

"After 26 years continuous service in an industrial area, LOCKE SWITCH INSULATORS good enough for re-use on Union Electric 138 KV basic power loop."

reports "Mac" McVicker

"In 1951," says "Mac", "Union Electric tore down a 69 KV sub-station at Cahokia, Missouri, a congested industrial area.

"This sub-station had been built in 1926 using some 265 Locke Switch Insulators. Union Electric intended to junk all unusable equipment, since a new 138 KV sub-station was to be erected on the site. However, engineers noted that even after 26 years of continuous, uninterrupted service, the 265 Locke Switch Insulators appeared to be in excellent condition. These insulators were cleaned, high-potted and power-factor tested and the major portion of them are now being used on the new Clark 138 KV sub-station. The remainder were used in the construction of 138 KV arrester bases and for building 138 KV switches for other parts of the Union Electric system. Certainly," says "Mac", "here's another good example why leading utilities place their confidence in Locke Switch Insulators."

On next page "Mac" McVicker tells why Locke Switch Insulators often give you more than your money's worth.... →

"Mac" McVicker tells why **Locke Switch Insulators** survive and prosper in industrial area served by Union Electric Company of Missouri—

1. "Most important," says "Mac", "is protection of metal parts. Locke Permazinc galvanizing . . . a quality-controlled, double hot-dip method . . . assures the high degree of resistance required to survive industrial atmospheres.

2. "Note the uniformly smooth glazed surfaces which assure easy natural cleaning by wind and rain, and aid the insulator in maintaining its original excellent electrical characteristics."

3. "The Locke wet-process porcelain body . . . the toughest known by Locke . . . has been a standard of comparison since 1893," explains "Mac". "For this reason, Locke Switch Insulators easily survive power arcs, lightning flashovers, and rough handling."

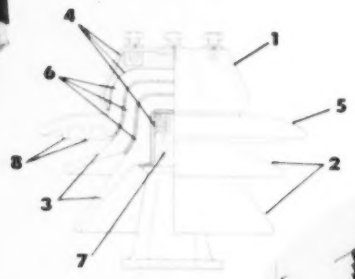
4. "Mac" points out that "the non-hardening, resilient coatings, applied to all unsanded, load-carrying surfaces, distribute loading efficiently and act as expansion joints under temperature changes. This contributes to longer life.

5. "Compression glaze . . . a Locke development . . . increases impact strength and eliminates craze to assure lasting smooth surfaces for easy natural cleaning."

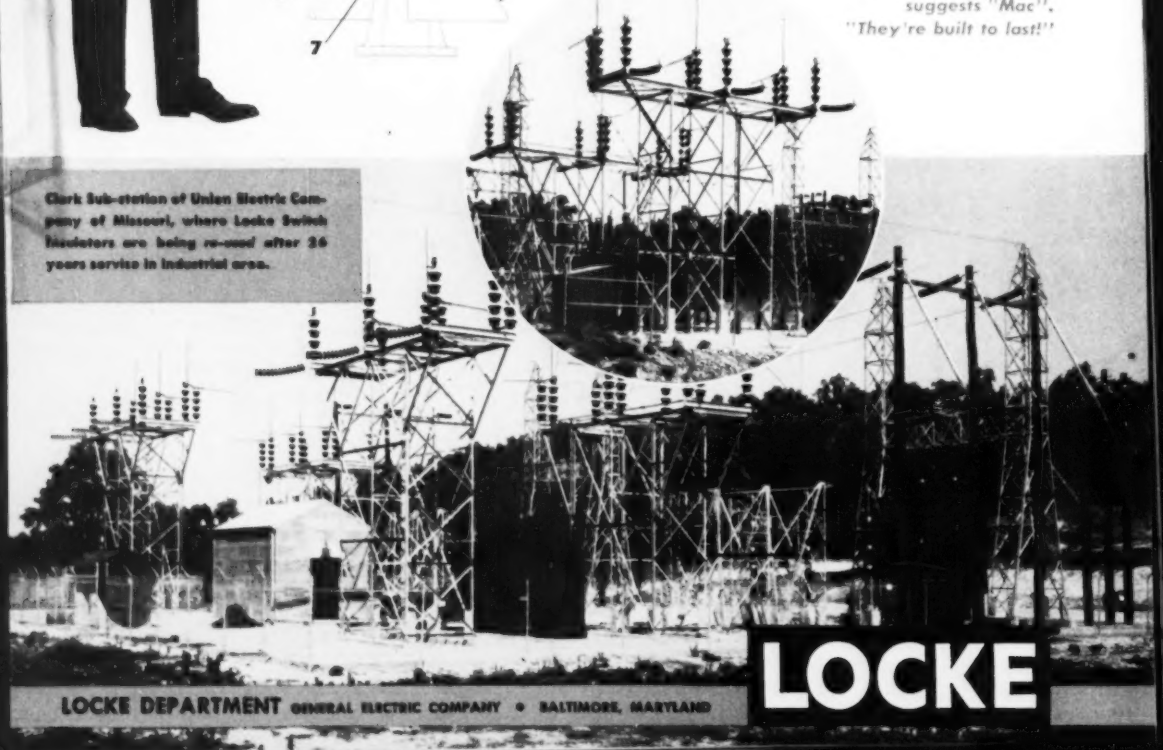
6. "Locke compression sand at the cement joints integrates the multiple shells into a permanent, high strength unit. No loose joints . . . no cracked shells," explains "Mac".

7. "The feature of vertical ribs on the inside of the caps and the outside of the pins provides high torsional strengths," adds "Mac".

8. "The contours of the corrugations," says "Mac", "have been developed to give maximum resistance to mechanical impact. Their depth assures full leakage distance."



"Specify Locke Switch Insulators by catalog number," suggests "Mac". "They're built to last!"



Clark Sub-station of Union Electric Company of Missouri, where Locke Switch Insulators are being re-used after 36 years service in industrial area.

LOCKE DEPARTMENT GENERAL ELECTRIC COMPANY • BALTIMORE, MARYLAND

LOCKE

THE Nicopress SLEEVE

WITH THE Nicopress TOOL

...GIVES YOU A PERFECT NICOPRESS SPLICE

For use on Copper, Copperweld, A.C.S.R. and Steel power conductors.

Nicopress is the Registered Trade Mark of The National Telephone Supply Company

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THE NATIONAL TELEPHONE SUPPLY COMPANY

T&B METHOD
Fittings and Tools for ALUMINUM and Copper Conductors

FOR ACSR & ALL-ALUMINUM CABLES

Tension Splicers

Dead Ends

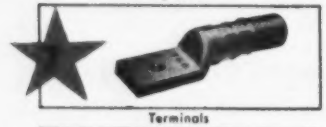
Jumper Splicers

Repair Sleeves

Light Portable Tools (for tower work)

FOR UNDERGROUND & INDOOR INSTALLATION

Splicers



Terminals

Taps

Connectors

CONDUCTANCE OF ACSR DEAD ENDS* IS BETTER THAN THE CABLE'S... when you use T & B Method Fittings

The body of a T & B Dead End for ACSR — a single aluminum tube — forms an uninterrupted current path. Conductance is higher than for the same length of cable! Patented T & B Method of compression scrapes oxide off cable for high cable-to-fitting conductance — develops 95% or more of listed cable breaking strength. You get a top-quality job — electrically and mechanically — with T & B Method Fittings!

TOOLING IS LIGHT — PORTABLE — POWERFUL . . . AND ECONOMICAL!

Tools are easy to carry — easy to use. An installing head weighing only 45 pounds develops 40-ton pressure. T & B Method saves you money because one tool and die install all fittings for a single size of ACSR cable.

ENGINEERED RIGHT . . . DISTRIBUTED RIGHT

T & B Method fittings and tools, like all T & B quality fittings, are designed for lowest installed costs. They're furnished exclusively through local T & B distributors under the T & B Plan.

FROM CIRCLE TO HEX IN SECONDS

You start with a circular cable (a typical one consists of about 75% metal, 25% air). You compress it, by the T & B Method, to the equivalent area of a solid rod—as the dies force the fitting from circular to the characteristic T & B Method hexagonal shape—all in the space of just a few seconds!

FOR THE FULL STORY ON THE T & B METHOD, WRITE FOR BULLETIN 67

THE THOMAS & BETTS CO.

INCORPORATED

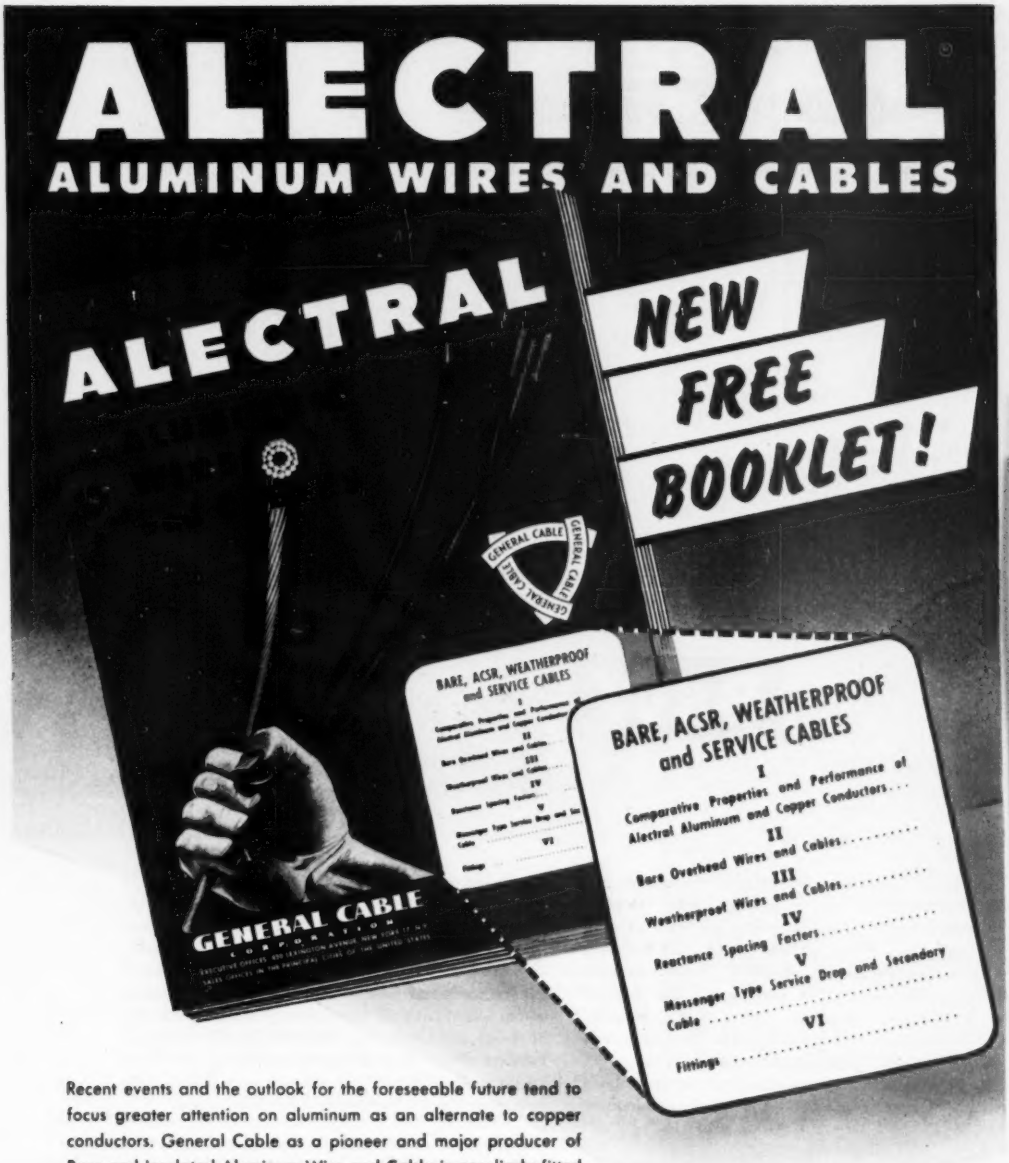
35 Butler Street
Elizabeth 1, New Jersey
Thomas & Betts, Ltd., Montreal, P. Q., Canada

THERE'S A T&B ENGINEERED PRODUCT for every wiring job in the complete T & B line of fittings for all conductors and raceways

● Manufacturers of Electrical Fittings

ALECTRAL

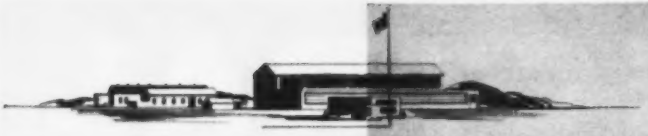
ALUMINUM WIRES AND CABLES



Recent events and the outlook for the foreseeable future tend to focus greater attention on aluminum as an alternate to copper conductors. General Cable as a pioneer and major producer of Bare and Insulated Aluminum Wire and Cable is peculiarly fitted to service the industry with both aluminum and copper. They have assembled in compact form the principal data re: bare, weatherproof aluminum and ACSR line wires and service drop cables. Write today on your company letterhead for your copy of this booklet.

GENERAL CABLE
CORPORATION

EXECUTIVE OFFICES: 420 LEXINGTON AVENUE, NEW YORK, NEW YORK • SALES OFFICES IN PRINCIPAL CITIES OF THE UNITED STATES



From B&W Research and Development . . .

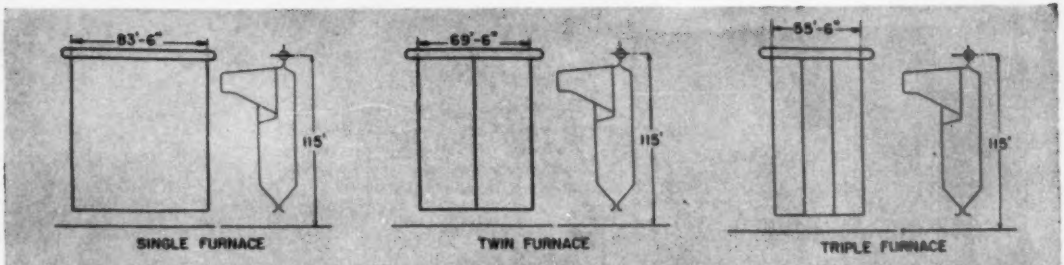
a practical solution to cost problems...

B&W DIVIDED

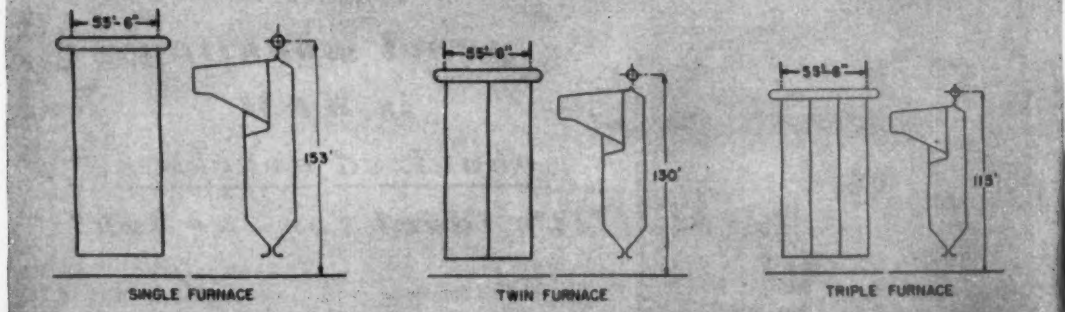
A practical, long-proved solution to rising construction costs may be found in the B&W Divided-Furnace Boiler. Whether it is a problem of conserving height, width, or both—especially for units with large heat input—B&W's Divided-Furnace design offers remarkable economies. The sketches on the opposite page show typical savings in space for twin-furnace and triple-furnace construction as compared with single-furnace construction.

A furnace division wall receives heat from both sides and therefore must be assured an adequate supply of water. With the B&W Cyclone-Steam Separator, circulation in division walls of B&W boilers has always been more than ample—as proved by long-term central station operation at boiler design pressures as high as 2650 psi. Many years of experience stand behind B&W's Divided-Furnace construction with all types of large units—Radiant, Stirling, and Open-Pass. Over 75 B&W Divided-Furnace Boilers are in operation—many for over 10 years—and more than 80 units are under construction, for the following electric utilities:

Alabama Power Company • Appalachian Electric Power Company • Arkansas Power & Light Company • Cincinnati Gas & Electric Company • City of Los Angeles • Cleveland Electric Illuminating Company • Commonwealth Edison Company • Consolidated Edison Company of N. Y. Inc. • Consolidated Gas, Electric Light & Power Company of Baltimore • Dallas Power & Light Company • Detroit Edison Company • Duquesne Light Company • Electricite France • Georgia Power Company • Houston Lighting & Power Company • Indiana & Michigan Electric Company • Jersey Central Power & Light Company • Kentucky Utilities Company • Long Island Lighting Company • Middle South Utilities, Inc. • Monongahela Power Company • Niagara-Mohawk Power Corp. • Northern Indiana Public Service Company • Ohio Edison Company • Ohio Power Company • Pacific Gas & Electric Company • Pennsylvania Electric Company • Philadelphia Electric Company • Public Service Company of Colorado • Public Service Company of Northern Illinois • Public Service Company of Indiana Inc. • Public Service Company of Oklahoma • Public Service Electric & Gas Company • Southern California Edison Company • Tennessee Valley Authority • Texas Electric Service Company • Texas Power & Light Company • Toledo Edison Corp. • Union Electric Company • West Penn Power Company • Wisconsin Power & Light Company



EFFECT OF DIVISION WALLS ON BOILER WIDTH—KEEPING HEIGHT CONSTANT



EFFECT OF DIVISION WALLS ON BOILER HEIGHT—KEEPING WIDTH CONSTANT

FURNACE

Division wall furnace construction is used in combination with other significant achievements of B&W Research and Development, including the Cyclone Furnace, Pressure-Firing, Gas Recirculation, and improved alloys for high steam temperatures. Widely accepted throughout the power industry, these modern B&W advances are making major contributions to more economical and reliable steam generation.

B&W's continuing program of progressive research combined with its broad experience in designing and building boilers with the highest capacities in existing pressure-temperature ranges, assure you of the most efficient and economical solutions to your specific steam generation problems.

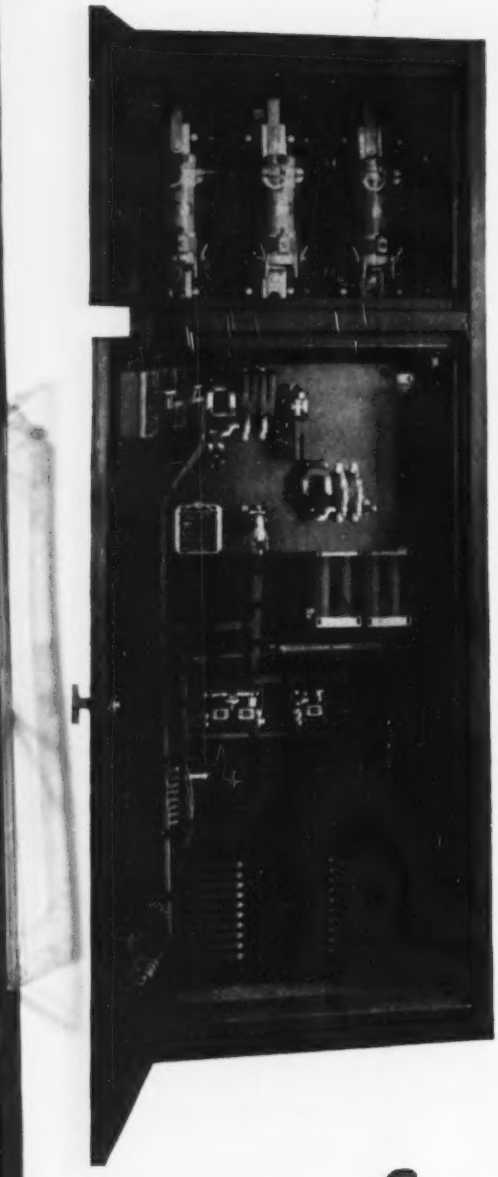
ADVANTAGES OF DIVIDED FURNACE CONSTRUCTION

- Provides greater cooling area without increasing furnace volume
- Reduces steel and other material costs by keeping boiler and building volume to a minimum
- Lowers furnace construction costs
- Cuts operating costs by reducing slagging in furnace and in convection surface

Triple furnace boilers for 1 boiler—1 turbine units of over 200,000 KW capacity are now being constructed

BABCOCK & WILCOX

G-5697



K&M Ebonized Asbestos is used for the swing-out relay panel in this Hi-Fuse Control for 400 h.p. synchronous motor manufactured by Electric Machinery Mfg. Company, Minneapolis, Minn.

When a panel mounting is K&M ebonized asbestos it's ideal for the job!

There isn't a more ideal mounting material than K&M Ebonized Asbestos. That's because K&M Ebonized Asbestos was conceived and built to do a better mounting job. It is compounded of mineral asbestos fibers and binding cement, pressure molded to high density and impregnated with a special insulating compound.

This combination of materials and processes produces a mounting material which is:

1. ***Unusually strong—both dielectrically and mechanically;***
2. ***Highly resistant to shock, vibration, and temperature changes;***
3. ***Of uniform density throughout;***
4. ***Easy to machine, cut, drill, and handle.***

K&M Ebonized Asbestos is available in sheets 42" x 96" from 1/8" to 4" thick and in sheets 48" x 96" in thicknesses from 1/4" to 2". It may also be ordered cut to specific sizes, with edges beveled if desired.

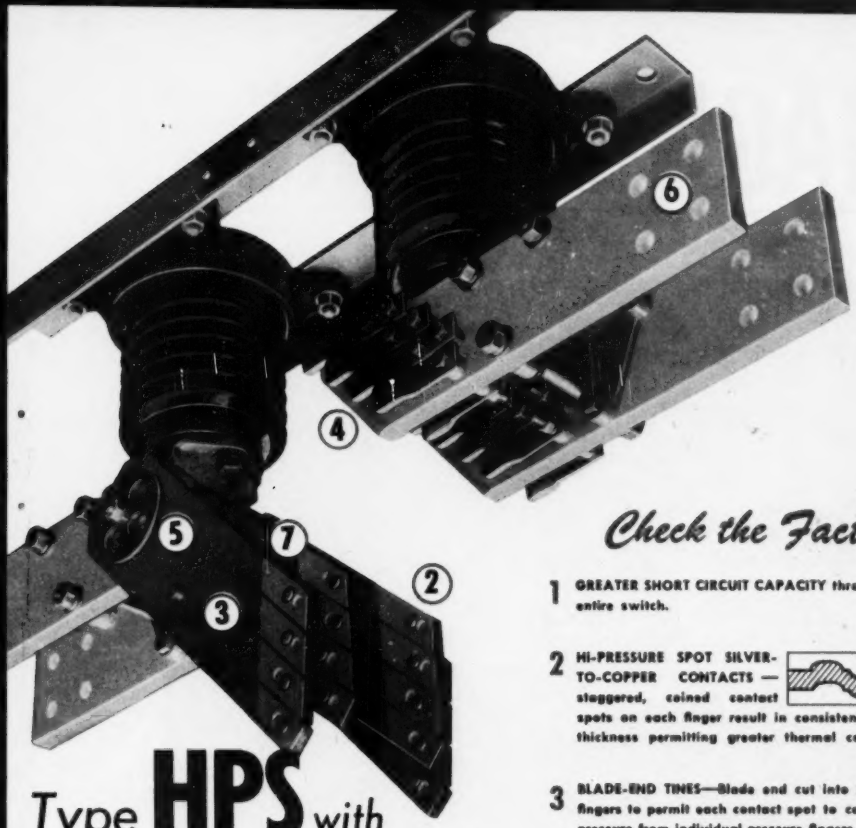
We'll be glad to send you complete information on how you can benefit with K&M Ebonized Asbestos, whether you manufacture or use switchboard mountings, bus bar runs, switchgear compartment linings, test tables, bench boards, or any panel-mounted electrical equipment.

Nature made Asbestos...
Keasbey & Mattison has made it serve mankind since 1873

K&M best in asbestos

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

In Canada — ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG AND VANCOUVER



Type HPS with IMPROVED R&IE SWITCH CONTACTS

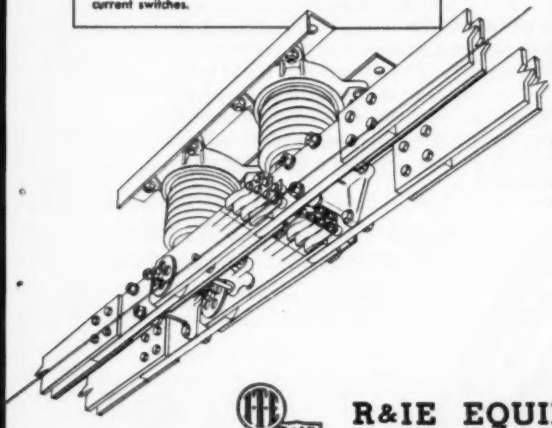
Check the Facts

1 **GREATER SHORT CIRCUIT CAPACITY** throughout entire switch.

2 **HI-PRESSURE SPOT SILVER-TO-COPPER CONTACTS** — staggered, coined contact spots on each finger result in consistent blade thickness permitting greater thermal capacity.

3 **BLADE-END TINES**—Blade end cut into tines or fingers to permit each contact spot to carry full pressure from individual pressure fingers.

STRAIGHT-LINE CURRENT PATH of 100% conductivity materials—a distinctive feature found on R&IE high current switches.



4 **BERYLLIUM COPPER PRESSURE FINGERS**—for high conductivity and proper application of strength and resiliency.

5 **HI-PRESSURE HINGE CONTACTS**—uniform pressure in all blade positions through annular, line contact blade surface.

6 **SILVER-PLATED TERMINAL**

7 **EASY BLADE OPERATION**—through sequential blade movement. Contact pressure released from inside pair of blades before outside pair start travel.

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER COMPANY
GREENSBURG, PA.

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

MAGNET WIRE

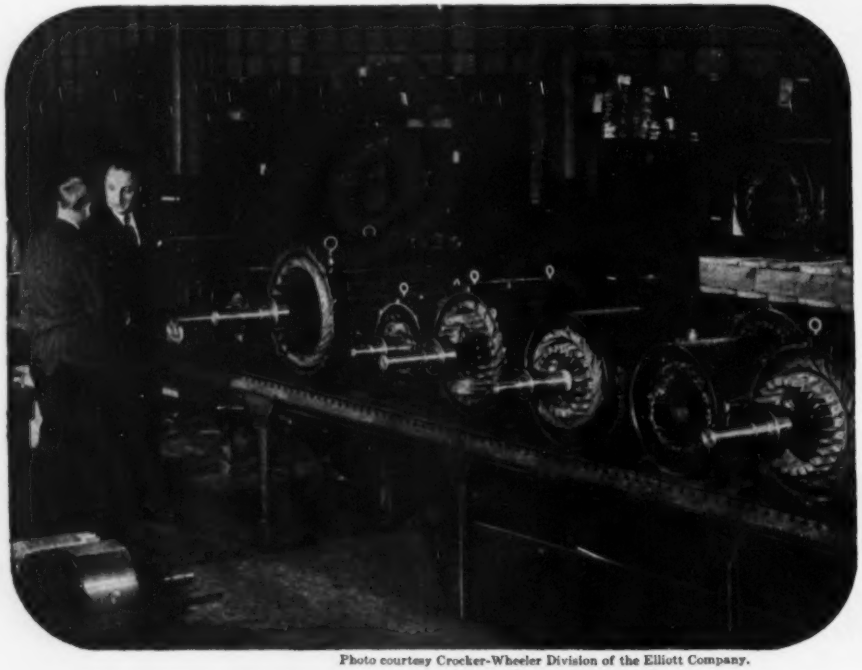


Photo courtesy Crocker-Wheeler Division of the Elliott Company.

Roevar . . . you can't buy a finer magnet wire

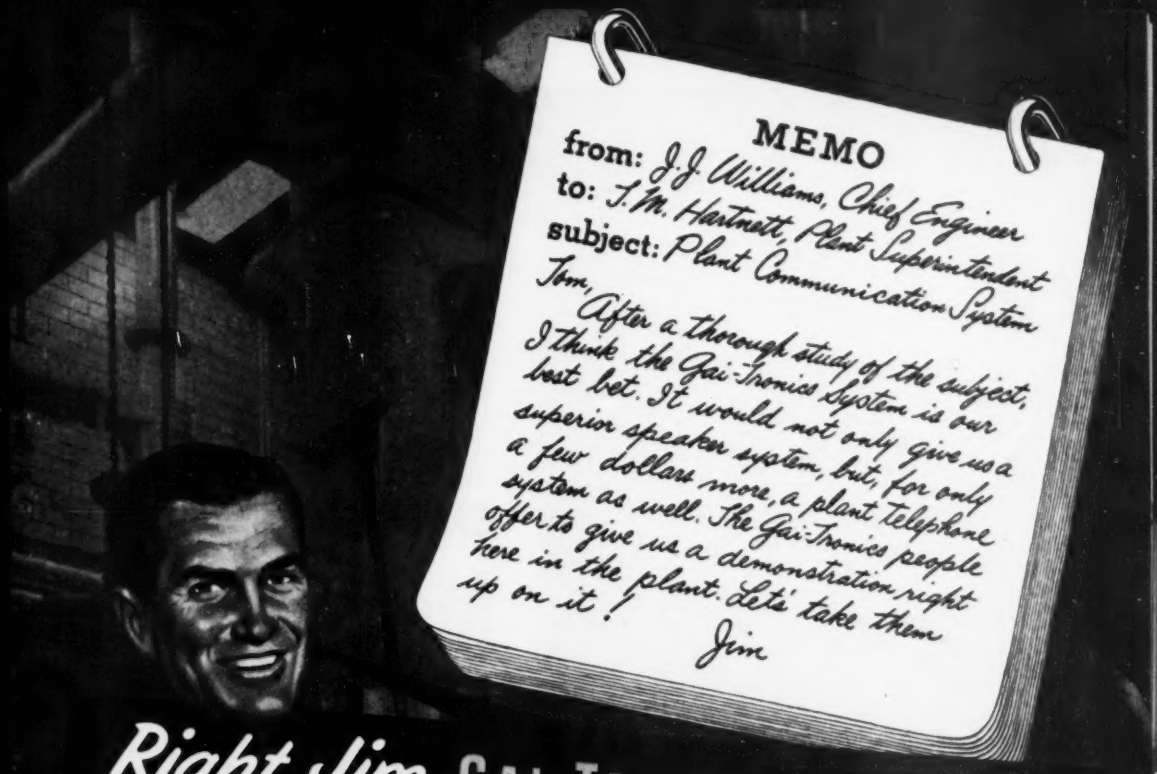
CONTINUAL IMPROVEMENT is a distinguishing feature of Roebling's electrical wire and cable line. And to make Roebling Roevar Magnet Wire today's A-1 specification for high speed winding, we use the toughest insulation we know of.

This Roevar insulation is *many times* more abrasion-resistant than conventional enamels. It is highly resilient . . . bends to a remarkable degree without cracking or coming loose from the conductor. On top of that, it has extra resistance to the solvents that are used in coil-treating varnishes and to all usual baking temperatures.

Roevar Magnet Wire comes in sizes No. 14 to 40 A.W.G. . . . and its small diameter is an important factor in many applications. You can depend on us for the best deliveries possible under today's conditions. John A. Roebling's Sons Company, Trenton 2, N. J.

ROEBLING

ATLANTA, 934 AVON AVE • BOSTON, 51 SLEEPER ST & 5 PITTSBURGH ST • CHICAGO, 5525 W. ROOSEVELT RD • CINCINNATI, 3253 FREDONIA AVE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST • DETROIT, 915 FISHER BLDG • HOUSTON, 6216 NAVIGATION BLVD • LOS ANGELES, 5540 E. HARBOR ST & 120 S. HEWITT ST • NEW YORK, 19 RECTOR ST • ODESSA, TEXAS, 1920 E. 2ND ST • PHILADELPHIA, 230 VINE ST • PITTSBURGH 1301 CLARK BLDG • ROCHESTER, 1 FLINT ST • SAN FRANCISCO, 1740 17TH ST • SEATTLE, 900 1ST AVE S. • ST. LOUIS, 3001 DELMAR BLVD • TULSA, 321 N. CHEYENNE ST • EXPORT SALES OFFICE, TRENTON 2, NEW JERSEY


MEMO
from: J.J. Williams, Chief Engineer
to: J.M. Hartnett, Plant Superintendent
subject: Plant Communication System
Jim,
After a thorough study of the subject, I think the Gai-Tronics system is our best bet. It would not only give us a superior speaker system, but, for only a few dollars more, a plant telephone system as well. The Gai-Tronics people offer to give us a demonstration right here in the plant. Let's take them up on it!
Jim

Right, Jim, GAI-TRONICS GIVES YOU TWO COMMUNICATION SYSTEMS IN ONE

Only by choosing a GAI-TRONICS Power Plant Communication System, can you get a *complete* system—far more versatile than an ordinary public address hookup with an unhandy, separate intercom.

GAI-TRONICS Systems are *custom-engineered* by Power Plant Design Engineers—men who know the problems and needs of top-notch power plant communication. GAI-TRONICS speakers and telephone handsets are specially designed for power plant operation. Even under the highest and most unusual noise levels, hearing and speaking are easy, completely unstrained.

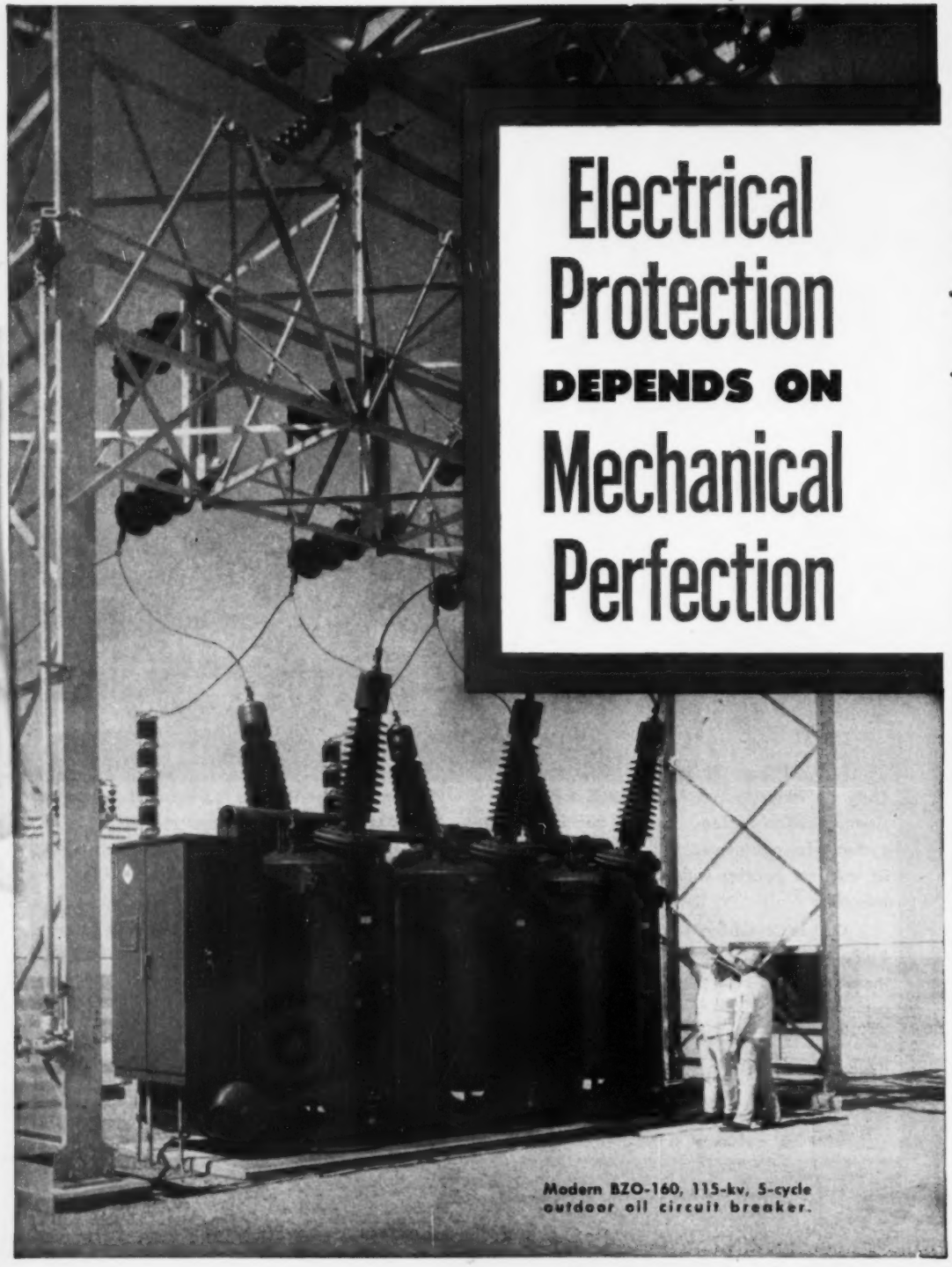
With but a flick of a switch it is possible to change from speaker use to personal two-party or group telephone conversation. No need for two individual systems—each with its own wiring, devices, maintenance, *and expense!*

To everyday power plant operation, GAI-TRONICS brings a new standard of efficiency. During an emergency, *fast, sure* GAI-TRONICS communication can avert disaster—can more than pay for itself in a few minutes.

FREE

We want you to know more about GAI-TRONICS. At your request, we will send you an informative booklet . . . *Power Plant Communication Systems.* OR, we will be glad to give you an eye-opening demonstration with a portable GAI-TRONICS System *in your plant!* Write today!

GAI

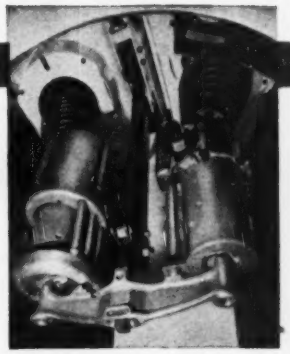


Electrical Protection DEPENDS ON Mechanical Perfection

Modern BZO-160, 115-kv, 5-cycle outdoor oil circuit breaker.

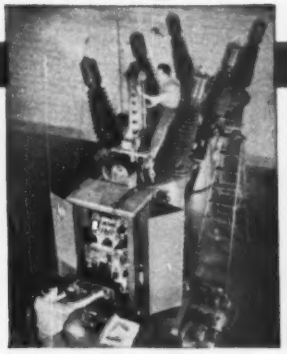
Time-Proved
Mechanically Trip-Free
Pneumatic Operator

Electrical protection depends on *fast breaker operation under all conditions.* Only mechanically trip-free operation assures this because breaker contacts open independently of the operating mechanism. And such operation provides fast recoupling for immediate reclosing.



Time-Proved
Turbo-Ruptor* and *Turbo-Jet
Interrupting Devices

Electrical protection depends on *fast circuit interruption.* A-C low arc energy devices employ directed oil turbulence for swift arc extinction; self-cleaning, low resistance contacts assure low operating temperature. The result is minimum contact and oil deterioration.



Time-Proved
Electrical and Mechanical
Pre-Shipment Testing

Electrical protection depends on *unfailing, coordinated operation.* A-C breakers are designed to provide that operation and are thoroughly tested to assure it. Before shipment, electrical and mechanical operation is verified by rigid checks and special test equipment.

Turbo-Ruptor and *Turbo-Jet* are Allis-Chalmers trademarks.

Type BZO OIL CIRCUIT BREAKERS

Details Contribute to Dependability

Double-hinged, gasketed mechanism housing doors . . . white enameled tank interiors . . . large, hinged tank manhole covers — these and many other details provide easy accessibility for inspection and contribute to the over-all reliability of Allis-Chalmers circuit breakers.

RATINGS

From 69 to 230 kv . . . 1,500,000 to 10,000,000-kva interrupting capacity . . . 5 and 3-cycle interrupting times . . . repetitive reclosing service to meet the industry's fastest requirements.

For more information about these Type BZO oil circuit breakers, ask your nearby A-C representative for Bulletin 71B6022, or write to Allis-Chalmers, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-3743

INSTALLED 1939

Still Requires Practically No Maintenance!

This C-D capacitor installation has been on the job for an eastern utility since 1939. Its impressive record of "little or no maintenance required", year after year, confirms the time-tested dependability of the Cornell-Dubilier capacitor.

A talk with a C-D engineer can save you important maintenance dollars on your next power-factor installation. Cornell-Dubilier Electric Corp., Dept. D-12, South Plainfield, N. J.

CORNELL DUBILIER

WORLD'S LARGEST MANUFACTURER OF

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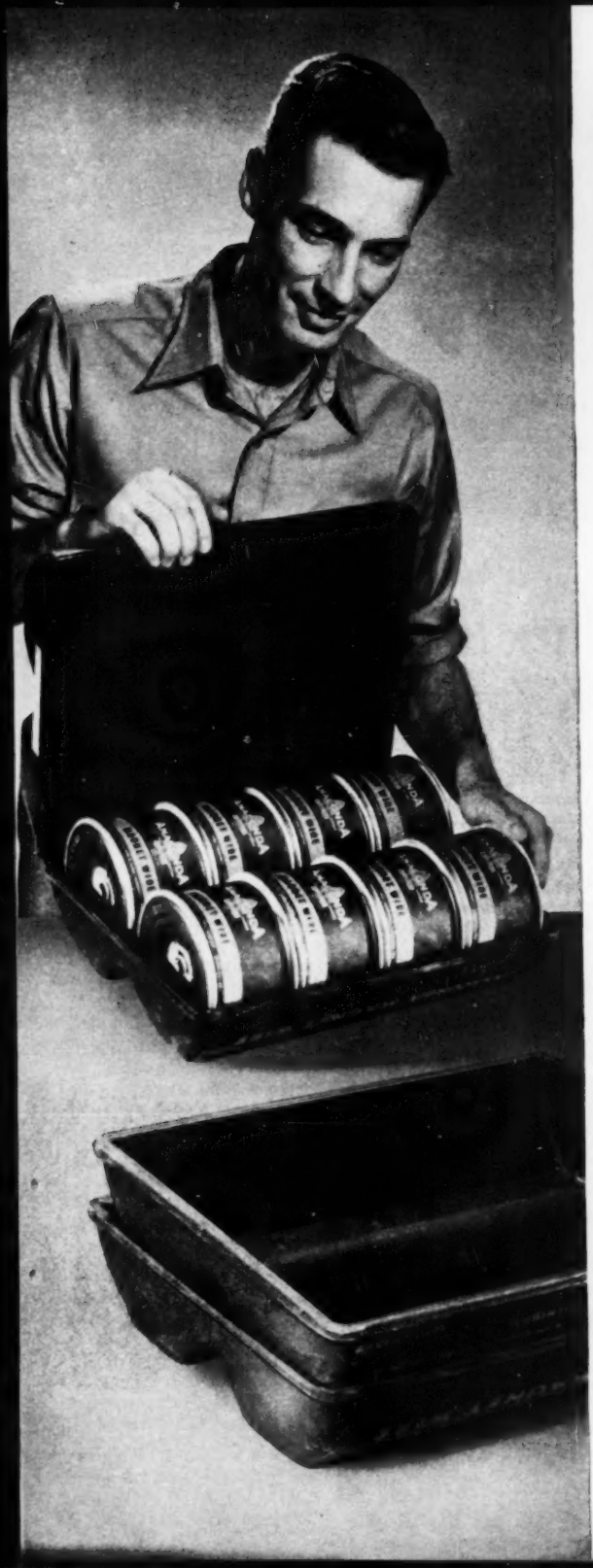
PLANTS IN SO. PLAINFIELD, N. J. • NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS. • PROVIDENCE, R. I. • INDIANAPOLIS, IND. • FUQUAY SPRINGS, N.C. • SUBSIDIARY, RADIART CORP., CLEVELAND, O.



ANACONDA MAGNET WIRE

TOM FOLGLASE of Anaconda receives 1st award from General Chairman A. S. Roberts at Chicago Industrial Packaging and Materials Handling Exposition.

PRIZE-WINNING
MOLDED SHIPPER

No problem plagues magnet-wire users more than damage to wire shipped in easily-broken wood boxes. Difficult to detect, even the slightest injury can conceivably impair the performance of finished windings.

Now a special fibre-molded case* protects wire spools from rough, tough handling in transit, stockroom and shop. Developed and used by Anaconda, this new container won top honors at the recent 7th Annual Exposition of the Society of Industrial Packaging and Materials Handling Engineers.

Made in identical halves, it has met severe tests . . . tests under which the best conventional wooden boxes burst. After one hundred 30-inch drops, the new case *still retained its wire spools in perfect shape.*

This molded shipper is ⅔ lighter, handles easier, stores in less space, nests compactly when empty. From factory to your workbench it safeguards the exceptional quality built into all ANACONDA Magnet Wire—Formvar, Enamel, Vitrotex† and the others. Ask for full details. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

58366

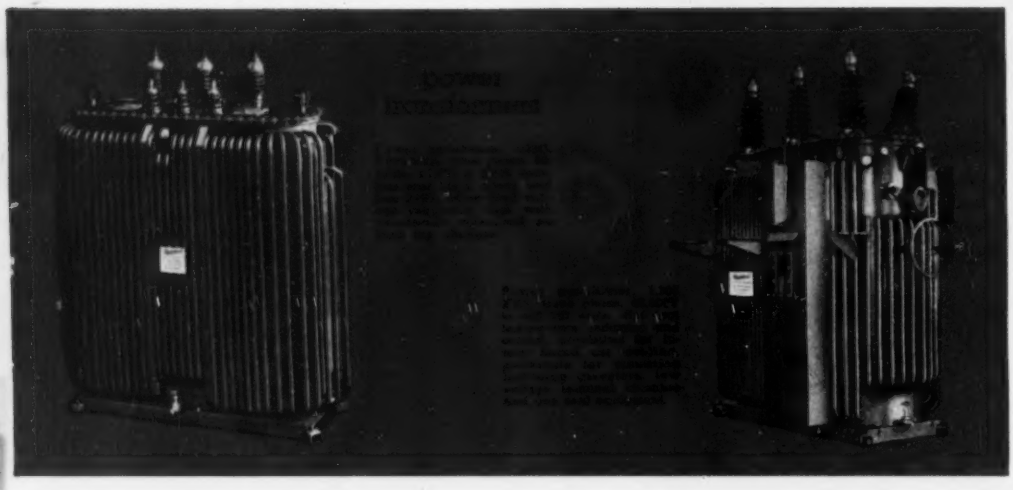
the right magnet wire for the job

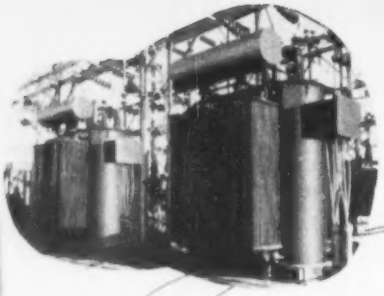
ANACONDA®

*patent applied for †reg. U.S. Pat. Off.

OLD AND NEW. Here the new molded fibre containers carry the same wire weight as 24 wooden boxes.

←**TRAY-LIKE FIBRE CASE** is sturdy, handy, has no sharp corners, nail or sliver hazards. Top nests in bottom half . . . takes ⅓ the space of wooden empties.





When dependability is a factor...

● Dependability in a transformer to you means trouble-free performance and long service life. To us, this means dependable construction.

For example, at STANDARD . . .

Tanks are built of rust-resisting steel, arc welded seams and tested under pressure. Liberal clearances are allowed from the windings and leads to tank and cover.

On the outside . . . attractive, long-wearing finishes with a primer coat and two finish coats of blue-gray enamel . . . on the inside, a lining of red oxide.

Covers are carefully and accurately fitted.

Tap changers and accessories efficiently placed with a specially designed tap changer switch.

These are just a few of the construction factors which STANDARD builds into Power Transformers. Look to STANDARD when you want dependability.

Everything Points To...

WRITE FOR BULLETIN CL-50

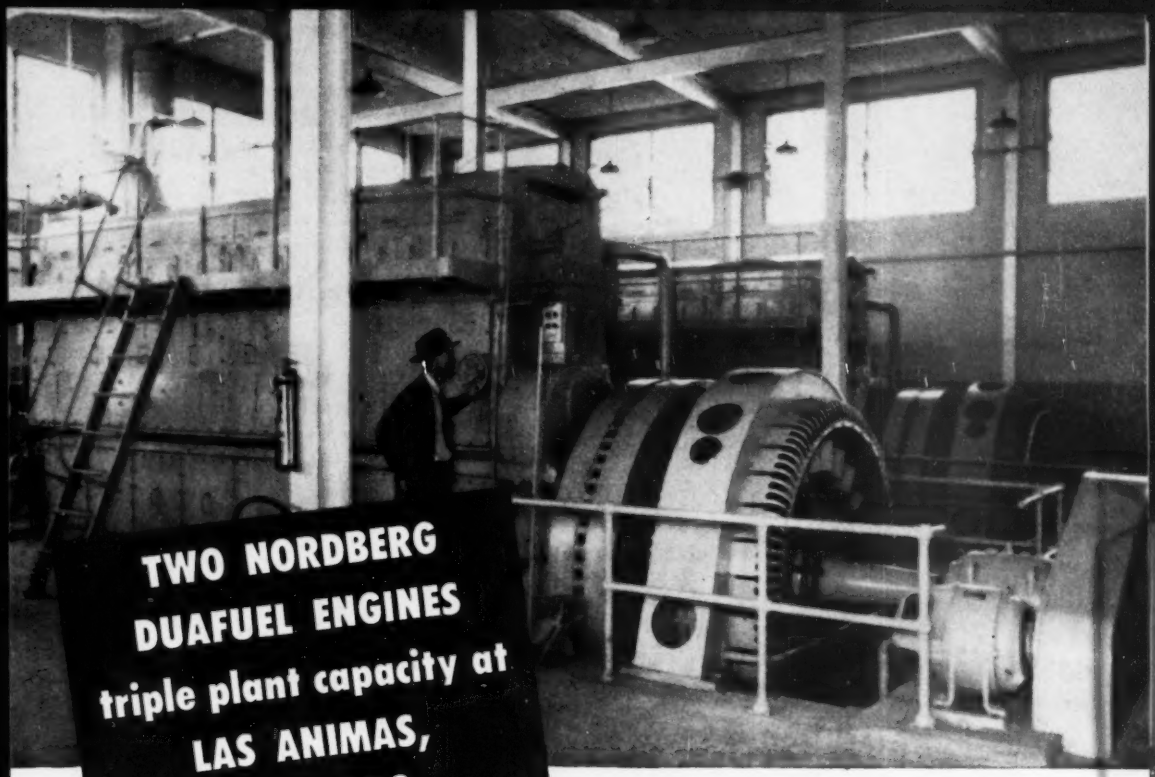
Tells the story with words and pictures of STANDARD'S complete line of transformers, and how they perform for every class of service . . . on the job.

Standard

THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES



TWO NORDBERG DUAFUEL ENGINES triple plant capacity at LAS ANIMAS, COLORADO

DUAFUEL UNITS TAKE OVER BULK OF LOAD FROM OIL BURNING ENGINES AND PURCHASED POWER: WILL BOOST PROFIT $50,000 A YEAR

Two new Nordberg Duafuel engines installed in the Las Animas Municipal Light & Power plant at Las Animas, Colorado are already setting an enviable record of service. Since the engines were installed late in 1951, plant capacity has been tripled and an era of low production costs and high profits has been introduced. Now — for the first time in its 10 year history, the Las Animas plant is capable of carrying the city's demand, independent of purchased power. Cost studies indicate that there will be an increase in electric department profits of $50,000 a year.

The Nordberg installation comprises one 1610 hp supercharged unit and one 1165 hp non-supercharged Duafuel engine. Both are four-cycle engines with eight cylinders of 16" bore and 22" stroke, developing rated horsepower at 327 rpm. Capacities of the engines are respectively 1130 kw and 735 kw.

Las Animas acquired its municipal power plant in 1941 from a private utility serving the area. The city then installed in the power house 3 Diesels, with sea level ratings of 450 hp, 375 hp and 225 hp giving Las Animas an effective capacity of less than 750 kw. Peak load originally was 600 kw and rose continuously year by year to finally reach 1200 kw in 1950.

This meant increasing dependence on the utility company and entailed ever larger demand charges plus the cost of purchased power. Concurrently fuel prices and other operating costs were rising and in 1950 the 2,883,000 kwh purchased cost $37,228.02 or 12.91 mills per kwh. The oil-burning engines produced a net of 2,267,680 kwh (after deducting plant use) at a total cost of $35,506.04 or 15.66 mills per kwh.

With demand on the utility approaching the capacity of the existing transmission line, a survey developed that the best solution was plant expansion and utilization of available natural gas. With the installation of modern Nordberg Duafuel engines, using fuel costing less than 4 mills per kwh, it is now calculated that total generating costs at Las Animas will be only 6.6 mills per kwh.

Here is one more outstanding example of the ability of Nordberg Duafuel engines to slash power generation costs.

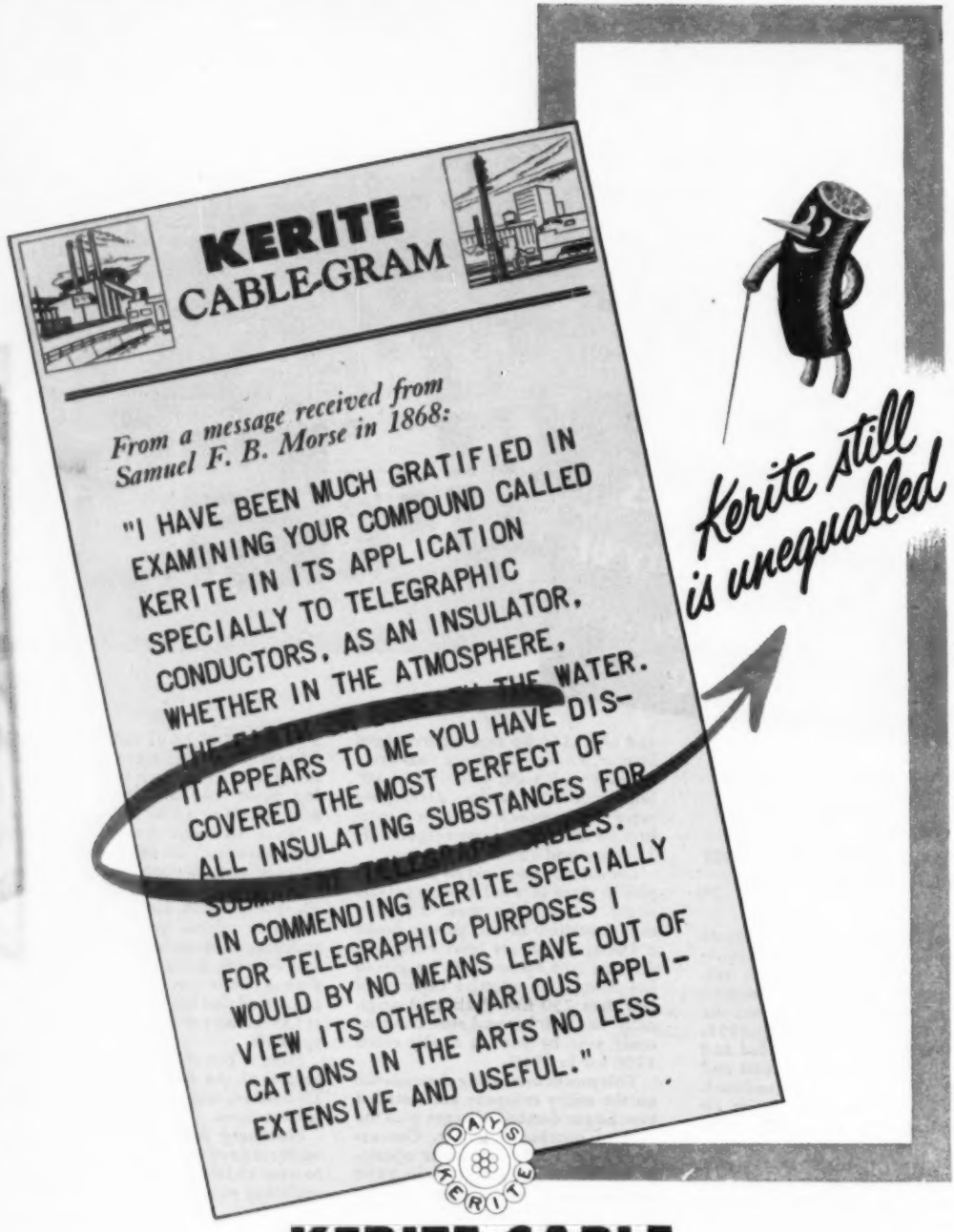
Nordberg engines are built in a wide range of types and sizes from 10 to over 10,000 hp. Write for details, outlining your power requirements.

NORDBERG MFG. CO., Milwaukee, Wisconsin

P352

BUSCH-SULZER
A DIVISION OF NORDBERG

NORDBERG
DIESEL ENGINES


KERITE
CABLE-GRAM
From a message received from Samuel F. B. Morse in 1868:
"I HAVE BEEN MUCH GRATIFIED IN EXAMINING YOUR COMPOUND CALLED KERITE IN ITS APPLICATION SPECIALLY TO TELEGRAPHIC CONDUCTORS, AS AN INSULATOR, WHETHER IN THE ATMOSPHERE,
IT APPEARS TO ME YOU HAVE DISCOVERED THE MOST PERFECT OF ALL INSULATING SUBSTANCES FOR
IN COMMENDING KERITE SPECIALLY FOR TELEGRAPHIC PURPOSES I WOULD BY NO MEANS LEAVE OUT OF VIEW ITS OTHER VARIOUS APPLICATIONS IN THE ARTS NO LESS EXTENSIVE AND USEFUL."
Kerite still is unequalled
DAYS KERITE

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco; 3901 San Fernando Rd., Glendale 4, Calif.

THE VALUE AND SERVICE LIFE OF A PRODUCT CAN BE NO GREATER THAN THE INTEGRITY AND CRAFTSMANSHIP OF ITS MAKER.

Utilities Can Lick Increased Costs

The struggle by utility management to hold down rates appears to have been successful. In spite of an 80% increase in the construction cost index in the past five years, the unit cost of electric plant has increased only 4%. Investment in total system has gone up from $301 per kw of generating capacity to $314 per kw. In this same period 1946 to 1951 the revenue per kw of capacity increased from $78 per kw to $82 per kw or 5%.

Rate of return has been decreasing. For the 12 months ending Aug. 31, 1952, gross income of class A and B utilities was up 9.9% compared with a 10.1% increase in utility plant. But for the past eight months percent increases in gross revenue have been well in excess of electric plant additions.

One other measure of the health of the utilities is the current decline in the operating ratio. After reaching a post war high of 50% (before depreciation and taxes) in 1948, it is now down to 45%. This is due to reductions in fuel, operating, and maintenance expense.

Credit for this fine record of accomplishment not only goes to the electrical and mechanical engineers but to management as a whole. The application of modern business methods has been receiving more and more attention. The use of manpower is far more efficient.

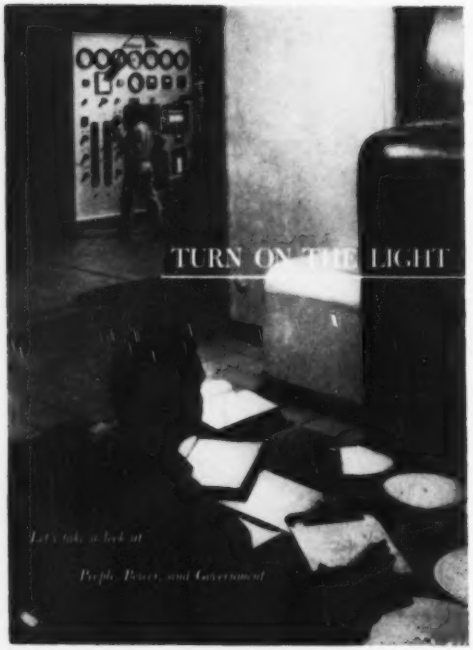
In large generating plants it takes one man for each 2,000 kw of capacity compared with two men four years ago. In the last 20 years the capacity per employee has gone from 106 kw to 270 kw and the customers per employee from 97 to 150. In this same period total use has quadrupled.

•

With this outstanding record behind us it would appear that the job had been done. It would seem that the dangers due to inflation and too strict regulations were behind. But unfortunately this is not the case. The cost of new generating facilities is 50% more than it was a few years ago. Fuel costs will tend to rise, and wages are likely to be on the up trend for some time. Depreciation accruals still do not provide adequate funds to cover plant replacements, and a reduction in income taxes is not now in sight.

It is therefore obvious that utility management must continue to use every means at hand in controlling the cost of investment and operating and maintenance expense. This can be done through more extensive use of modern management methods as well as by technical proficiency and mechanization of operations. A large percentage of the gains of the past has come as a result of substantial annual growth. For this reason, attention to promotional activities provides another important area for exploitation.

The results of the recent past prove that there are further efficiencies which can be applied. If these known areas for improvement are exploited, utilities can overcome increased cost of manpower and materials.



Turn on the Light

Have you ever tried to explain your company's side of the private-Federal power fight? Have you ever tried to explain it to your next door neighbor who was not exactly interested, just a bit curious? Honestly, how well did you succeed? Did your statistics enmesh him? Did your rhetoric bewilder him? Did you leave him in the darkness? And weren't you lost in the darkness yourself? Then TURN ON THE LIGHT.

This is the booklet you should have read before trying to inform your neighbor. In ten pages this 20-page booklet gives the private-Federal power fight as the investor-owned companies see it. Here are terms such as "public power," "cheap power," "excessive profits," "socialism," "monopoly," and "yardstick" explained so lucidly that even a teenager can understand them. Here at last is an industry booklet written in the language of the people. It belongs in your desk drawer, in your car, and in your home. It belongs in the hands of all those who should have the correct interpretation of this important economic controversy. You can put this booklet of the National Association of Electric Companies where it will do the most good if you will get copies from Ray Baker, Stephen Fitzgerald Co, 502 Park Ave., New York 22, N. Y.

Street Lighting and Crime

"It (street lighting) has diminished crime, for deeds of murder and robbery are usually accomplished under cover of darkness. Statistics prove that crime of all kinds has been diminished in the portions of cities that have been well lighted."

Except for its rather out-dated manner of expression, this quotation might be thought to be from a press release of the Street and Traffic Safety Lighting Bureau. The argument of crime reduction is the same. But when those words were printed, over 67 years ago in "Demorest's Monthly Magazine" of July, 1885, street lighting consisted of widely spaced, flickering carbon arc lamps. Even then its efficacy in prevention of crime had accumulated a weight of statistical evidence.

Modern street lighting of 67 years ago did not, of today does not, and of the future will not completely prevent crime on the public ways. But it did, does, and will diminish crime. That's what is confidently to be expected from it.

Instrument Engineers Are Key Men

Steadily increasing dependence on automatic controls is correspondingly increasing the importance of the instrument engineers who keep the controls in tune. Controls are intricate and often delicate mechanisms, particularly the measurement component that orders the rest of the combination into action. It is extremely helpful to have the switching station or plant operators at the elbows of the manufacturer's installation experts while such equipment is going in. They need that understanding of the details and the adjustments of the devices which supplement their own intelligence. But they can seldom be expected to take sole responsibility for the maintenance of them afterward. They have plenty to do as operators.

That's where the instrument engineer comes sharply into focus. He, too, should be close by when the controls and meters are put in place. He, too, will need to know how they function and in particular what are their limitations and idiosyncrasies. The operators should be so conversant with the apparatus that when the time comes for the start-up and trial run the manufacturer's representative should stand aside and let them push the buttons and close the switches. From that time forward the instrument man holds the key to reliable and efficient operation insofar as it hinges on the mechanization rather than the operating man-power.

It is not at all strange therefore to find many of the instrument engineers picked for supervisory positions when there are vacancies ahead or new system elements ready to take up their share of the load. Who else has at his command an equal knowledge of meters, instruments, relays, servomechanisms, and control generally—all at the core of dependable and economic functioning?

The Right Approach to Aluminum Connections

The many letters Electrical World has received on the many articles it has run on aluminum connection indicate the problem remains as vital as it is controversial. Now one industry body, the NEMA Electric Power Connector Group, has determined to do something about it. After extensive study, an application guide will be prepared for electric utilities. It will give the best possible recommendations for suitable connectors, methods of attachment to the conductor, protection of the joint, along with proposals for proper evaluation of fittings for aluminum conductors as compared with suitable and time-proven fittings for copper conductors. Such a guide will be eagerly awaited by the entire utility industry.

THE ELECTRICAL WEEK

The Issue's New Highlights—Comments have been favorable from both private and public power groups on the appointment of Oregon's Gov Douglas McKay to become Eisenhower's Secretary of Interior. He's a public project man but favors strong local participation.

Local participation in reclamation projects was urged by Reclamation Commissioner Michael Straus at the annual meeting of the National Reclamation Association.

Industry must lean less heavily on the federal government in putting the atom to work commercially, T. Keith Glennan, who retired recently from the Atomic Energy Commission, told the Manufacturing Chemists Association.

Off the Washington Wire—New administrator at Depa is James F. Davenport, vice president of Southern California Edison. For outstanding service in that post, retiring Depa administrator James F. Fairman won the Interior Department's distinguished service award. Fairman returns to Consolidated Edison of New York where he is a vice president.

To help administer the power conservation order in that area, Depa is reopening its Pacific Northwest regional office at the Federal Building in Tacoma. Joseph H. Gumz of Pacific G&E will head the office, and Harry Arnold Lee, also of PG&E, will assist him.

TVA has made another bid for top priority for materials to construct plants which will serve atomic energy installations. If granted, some Depa men fear that it will disrupt other schedules of electric utility expansion . . . An FPC examiner has recommended that a preliminary permit be granted the Warrior River Electric Co-operative Association of Alabama for a proposed 35,600-kw hydro project in Blount County, Ala. . . . A map showing principal electric facilities in California has been published by the Federal Power Commission.

From New England—Connecticut L&P asks PUC to approve purchase of Clinton Electric L&P by exchanging 6.5 shares of CL&P for every share of Clinton . . . Three times as many Boston Edison customers are now cooking electrically as 11 years ago . . . New Hampshire governmental leaders are taking a dim view of a legislative interim commission proposal for a survey of Connecticut River power resources by the state utilities and water resources boards to the end that hydroelectric energy export from New Hampshire be prohibited. Forthcoming Littleton 150,000-kw project of New England Electric System looks like the political target behind the interim group's recommendation.

From West North Central—Majority of representatives of seven largest cities in Minnesota agree to a resolution to be submitted to next state legislature that will enable cities to impose public utilities gross receipts tax.

From West South Central—Wilson, Okla., citizens vote 649 to 13 to lease municipal electric facilities to Oklahoma G&E for a period of 25 years.

Construction—Kentucky Utilities plans a new steam plant in vicinity of Carrollton on Ohio River . . . Ohio Valley Electric Corp will break ground Dec. 4 for 1-million kw station to be built at Cheshire, near Gallipolis. Second ground breaking will take place Dec. 5 for 1.2-million-kw plant at Madison, Ind.

Financial—Electric Energy, Inc, plans to increase its capitalization to $159.7 million from its present $103 million. This is to take care of boosting its rated plant capacity to about 900,000 kw from the originally planned capacity of 652,000 kw . . . Ohio Edison will pay Dec. 31 a common quarterly dividend of 55¢ per share as compared with 50¢ in previous quarter.

Labor—TVA will begin negotiations with Tennessee Valley Trades and Labor Council early this month . . . WSB approves 8¢ an hour wage hike for 14,000 workers with Anaconda, Phelps Dodge, and Kennecott.

Public Relations—Electric Companies Public Information Program will hold its fourth Workshop Conference, Sept. 17-18, 1953, at Edgewater Beach Hotel, Chicago.

Rates—Three Oregon utilities, Portland General Electric, Pacific P&L, and Mountain States Power start billings under temporary surcharges because of increased steam generating costs to augment hydro energy during present acute shortage in Pacific Northwest.

Philadelphia Electric connected its millionth electric meter on Nov. 18 in the home of Mr and Mrs Nicholas Nagurne, 1130 Saint Vincent St.

St. Lawrence County Board approves resolution urging FPC to designate New York State Power Authority to develop St. Lawrence River power project with Canada.

Arkansas P&L and Farmers Electric Cooperative Corp of Newport make a deal for AP&L to take over distribution of electric power to residents of Gray's Addition to Newport. AP&L will pay about $50,000 for the right to serve them. Co-op gets an option to buy 21 miles of AP&L line in Independence County.

Pumping Units Double as Generators—By reversing two 8,100-hp pumps at Connecticut L&P Rocky River hydro station which were originally installed to store Housatonic River water in Lake Candlewood by synchronous motor drives, company obtains 7,000-kw capability increase. Overall pumping capacity totals 250,000 gpm.

Congratulations—On Jan 1 Detroit Edison will elect Arthur S. Albright as executive vice president, succeeding Paul W. Thompson who will retire. Thompson assumed this office today (Dec. 1) when James H. Lobban retired. Company names George A. Porter vice president in charge of engineering, construction, and operations. Charles R. Landrigan becomes vice president in addition to being controller . . . New Jersey Utilities Association elects Herbert E. Cliff, commercial manager of Public Service E&G, president.

McKay: Government Projects, Yes . . .

. . . but with strong local participation. That's the power stand of the Interior Secretary-designate

Oregon's Gov Douglas McKay

The man President-elect Eisenhower has chosen to be his Secretary of Interior has vigorously backed development of the country's natural resources.

Oregon Gov Douglas McKay, 59, definitely thinks the federal government should step in on power projects where private companies are unwilling or unable to do the job. But he apparently believes in a lot more local participation in project planning and control than does the incumbent Secretary, Oscar Chapman.

Despite this, Chapman had this comment on the appointment: "Governor McKay is a fine man, very capable. He is a personal friend; I am very pleased with Mr Eisenhower's choice."

Apt Choice . . . Eisenhower's selection of the business-minded Oregon governor appears to have been appropriate because of his active participation in development of the vast multi-purpose water projects in the Pacific Northwest. His confirmation by the Senate is expected.

His record as governor indicates that he favors local and state participation in area-wide developments, but also welcomes the federal government as a partner. This experience may serve him well in carrying out the broad general principles which Eisenhower outlined in campaign speeches.

Eisenhower hit hard at what he called the "whole hog" approach to resource development. He accused the present administration of forging ahead with federal development at the expense of state and local interests.

In Seattle, Eisenhower proposed creation of an interstate agency in which federal representatives would work with local interests in planning and coordination of public projects in the Columbia Basin. This proposal would seem to be very much in line with McKay's thinking.

Consistent Stand . . . The Oregon governor is consistent in his stand on local control, right down to giving public power a chance to win out over private development, if the people of the area so will it. For instance, he said recently that if the people of

Eugene and Klamath Falls, Ore., want to have public power, he would protect their right to vote such municipal ownership into existence.

As governor, McKay has built a solid record favorable to expanding development of his area:

- One of the most active members of the Columbia River Basin Inter-Agency Committee, he has sometimes urged that controversial projects be set aside temporarily so that work could proceed on the non-controversial ones.
- In his role as governor, he has appeared before Congressional appropriations committees to urge full-scale spending on such multi-purpose projects as The Dalles, Lookout Point, and Detroit Dams. He also asked that no appropriation cuts be made on the Willamette River Bank protection project. This flood control and erosion project he launched in 1937, while a state senator, calling for aid from federal funds.
- He has given his approval to a Reclamation Bureau report that included the controversial $360 million Hells Canyon Project in Idaho, but has not given an individual indorsement of the project.
- While favoring a general basin account plan permitting power revenues to be used to help repay reclamation costs, he has strongly opposed a Columbia Valley Authority of the TVA variety.

Points in Doubt . . . On the fine points of federal power policy, McKay's views are less well known. In urging construction of the larger projects, the Oregon governor emphasized the immediate need for more electric power in his state.

Just how McKay stands on government-construction of transmission lines, administration of the preference clause, and other matters of vital interest to public and private utilities is not known.

It may be significant that he has relied heavily upon the advice of the Army Corps of Engineers for some of his views on resource development. As Interior Secretary, he will direct the activities of the Bureau of Reclamation—which competes with the corps for some of the waterway projects.

McKay was born in Oregon on June 24, 1893. He was graduated from Oregon State College with a degree in Agriculture. He served in the Army in both World Wars, rising to Major in the Service Command.

After World War I he became a automobile salesman, establishing his own agency in Salem in 1927. He served as mayor of Salem from 1933 to 1934, and in the state senate from 1935 to 1940. Elected governor of Oregon in November 1948, he was re-elected for a four-year term in 1950. Since then he has served as chairman of the Western Governors' Conference.

Plugged for Ike . . . McKay was on the Eisenhower bandwagon months before the Chicago convention. He helped to keep Oregon in the Republican column even though Sen Wayne Morse resigned from the party and supported Adlai Stevenson.

When Morse challenged McKay to a public debate, the governor suggested that since Morse had been on both sides of the fence he might profitably stage a debate with himself.

Morse in turn let fly with this: "As far as McKay is concerned, he is a well-recognized stooge of the tidelands oil thieves, the private utilities gang, and the selfish interests of the country that places materialistic values ahead of human values."

On the other hand, Dr Paul J. Raver, Bonneville Power Administrator, said, "Gov McKay has worked diligently in furtherance of Willamette Valley dams and has contributed faithfully and generously to the work of the Columbia Basin Interagency Committee. I am convinced that the people of this region as well as the entire West can feel secure their development programs will be in good hands."

Changing the Course of a River

Tons of water and rock from the bed of the Waikato River, largest in New Zealand's North Island, are hurled skyward as the river is diverted into a new channel for a short distance. The diversion was the first step in the construction of a dam and power station. The job took one and a half tons of explosive.

Atomic Plans of Industry . . .

. . . must lean less heavily on federal government assistance, T. Keith Glennan tells Manufacturing Chemists Association

Industries should get together and do their share in developing atomic energy for industrial use and quit depending on the government to do it for them. This advice came from T. Keith Glennan in what he called his "valedictory" as a member of the Atomic Energy Commission.

Glennan, who is president of Case Institute of Technology, spoke Nov. 25 before the semiannual meeting of the Manufacturing Chemists Association in New York. It was his first public appearance since his resignation from AEC.

Asserting that the military, the public, the scientists, and industry all have an interest in atomic energy, he pointed out that only industry has no way of protecting its interest. The military has a liaison committee which maintains offices in the AEC's own headquarters and meets regularly with the commission. The public has the Joint Congressional Committee on Atomic Energy as its watchdog. The scientists have the General Advisory Committee appointed by the President.

Program for Industry . . . To fill industry's vacuum, Glennan made these suggestions:

- The formation of a national association of atomic industries, voluntarily and without governmental urging or subsidy, by those industrial concerns, institutions, and individuals who are actively engaged in atomic energy research, development, and operations.
- That this association be established in the District of Columbia and that it develop a close working relationship with AEC, the Joint Congressional committee, and other appropriate agencies of government.
- The broad aim and purpose of the association should be to foster and encourage, subject to the requirements of national security, the development and utilization of the peaceful applications of atomic energy in accordance with the best traditions of the American system of free competitive enterprise.

The useful purposes of such an association as seen by the speaker included:

1. It could provide a forum in which the atomic energy industry could arrive at an informed and perhaps a common position on such matters of vital concern to it as the ownership of atomic energy facilities, rights to patents, licensing regulations, health and safety standards, secrecy policies, personnel clearance policies, and contract and tax procedures.

2. It could provide a channel through which industry's position on these matters could be brought to the attention of the Atomic Energy Commission, Congress, and the public.

3. It could provide a mechanism for the acquisition and dissemination throughout industry of information on such matters as laws and regulations, business opportunities, and technological developments.

The former AEC member told the chemists that AEC, as he found it, is sympathetic to private enterprise but that it must operate under the provisions of the Atomic Energy Act. He predicted that the coming Congress will debate changes in that act. He advised industry to take its story to Congress if it expects to get what it wants.

"Industry must get into this atomic energy business with its own money and at its own risk. To do so it must take some real chances. And it must knock persistently on the government's door with ideas, suggestions, and concrete, well-thought-out proposals. In other words, I have been calling upon industry to exercise that talent which it is supposed to possess in such great abundance—initiative."

Key Personnel Selected for Posts at Atom Project

Organization of key personnel for the operation of the government's atomic energy plant, now under construction near Portsmouth in Pike County, Ohio, is underway at the Akron offices of Goodyear Atomic Corp, which will operate the project.

A. J. Gracia, manager of the newly fromed organization, a subsidiary of Goodyear Tire & Rubber Co, has announced names of additional supervisory personnel, as approved by Atomic Energy Commission. The men and their duties are: Robert B. Rutherford, head of utilities and utilities maintenance; Hugh F. Porter, Jr, head of electrical and instrument division; Ralph J. Nance, superintendent of shops maintenance; Thomas W. Leary, superintendent of process maintenance; Arthur J. Brust, superintendent of planning and scheduling; Nathan H. Hurt, Jr, superintendent of staff engineering. All the men have been transferred from posts in the Goodyear organization.

The atomic energy plant will be completed in about four years and will employ 4,000 persons.

Centralized Control Held Big Saving to Utilities

Centralized control in the 40 million kw of steam generating stations built since the war is saving utilities $150 million a year, P. S. Dickey, Bailey Meter Co, told Conference on Recording and Controlling Instruments at Philadelphia Nov. 18. The conference was sponsored by American Institute of Electrical Engineers.

This saving far exceeds the cost of the control equipment which makes it possible, he said. Moreover, he added, extensive use of instruments and controls has contributed substantially to holding costs down and lowering coal rates.

Centralized control rooms have become important for larger turbogenerators with single high-pressure high-temperature steam generators. In spite of the number of indicators and control stations, the cost of instrumentation per kw may be lower, he said.

Future power plants where one man may control as much as 900,000 hp require adequate recording equipment, said J. R. Leslie, Hydro-Electric Power Commission of Ontario. Beside indicators to alert the operator, there must be such equipment as automatic printing recorders to log protective equipment operations. But for engineering analysis of faults, detailed records of relay operations are needed for comparison with automatic oscillograms. Leslie described a recorder which electrically times on sensitized paper up to 165 functions. The paper starts automatically upon fault indication, reaches 60% speed in 0.025 second.

Standard strip chart recorders can be made to record upwards of 200 variables. This can be done, accord-

Electric Union Men Are Directing CIO

Two men active in the affairs of electric and utility unions will run the CIO until a new president is selected. They are James B. Carey, left, CIO secretary-treasurer and president of International Union of Electrical Workers, and Alan S. Haywood, CIO vice president. Haywood also is "adviser" to Utility Workers Union of America, a union he helped organize. He served as chairman of the utility workers' organizing committee from 1938 until 1946 when a constitution was adopted and UWUA officially launched.

ing to C. G. Dell and L. P. Haner of duPont, by modifying the roll mechanism to permit the rapid indexing of successive segments of a continuous loop of chart paper. A selector switch synchronized with the chart indexing device connects the pen to the several test points. By this method, he said, it is possible to record from four to 24 curves on each of any reasonable number of chart segments. Presenting related functions together in the same chart segment aids operators to supervise a process more closely, he said. It also materially lowers the investment for instrumentation.

Israel Setting Up Board to Study Power Program

TEL AVIV (McGraw-Hill World News)—A five-member board is being appointed to deal with all matters concerning public utility rates and planning as well as concessions to local and/or foreign private companies.

The goal is to increase the country's power capacity from 100,000 to 600,000 kw.

The step is related to development projects to be implemented with German reparations which are reportedly to include $47 million worth of power equipment.

Establishment of the new board is provided for in Israel's ten-year development plan, brain-child of Dr S. S. Throne, a former top official of the General Electric, who recommended the creation of such central authority to deal with the whole problem of electricity from generation to application.

Developing power production is the largest single foreign currency item in Dr Throne's scheme under which $47-million worth of equipment would be supplied by the Germans, $52 million is to be purchased in other countries with Israel funds, and the equivalent of $46 million is to be invested locally.

The Palestine Electric Corp has been asked whether it would be able to carry out such plans alone or would prefer a partnership with the government.

Relay System . . .

. . . between Public Service E&G, Philadelphia Electric stations described at PEA meeting

Since Dec. 29, 1951, microwave relaying has been relied upon for fast line clearing and transferred tripping between Public Service Electric & Gas Co's Camden Switching Station and Philadelphia Electric Co's Richmond Generating Station, G. W. McKenna, Philadelphia Electric, related. He spoke before the Pennsylvania Electric Association Relay Committee meeting on Nov. 13 at Newark, N. J.

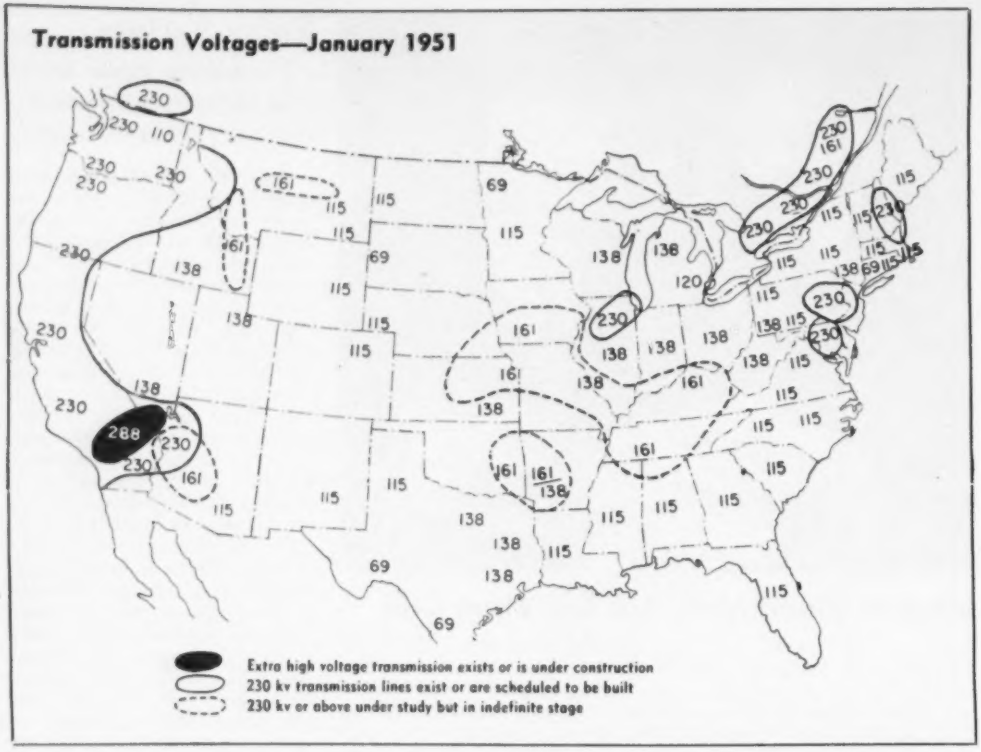
On the 2.25 mile, 132-kv interconnecting line, continued McKenna, as far as the operating experience with the protective relaying is concerned the only tripping operations so far have been on staged fault tests.

The frequencies are being changed to provide greater frequency separation between adjacent channels on the Camden-Richmond microwave radio installation, reported F. H. Travers, Philadelphia Electric. The reason—some difficulty has been experienced in maintenance of the frequency shift tone channels. After the changes, remote tripping frequencies will be 3,300 (the same) $\pm$ 175 cycles and 4,700 (instead of 3,900) $\pm$ 175 cycles; line relaying channel will be 10,700 (instead of 11,500) $\pm$ 300 cycles; and the spare-channel will remain 12,700 $\pm$ 300 cycles.

A generator negative-sequence current relay has been developed to remove the machine from the line before it is subjected to possible damage, according to J. E. Barkle, Westinghouse Electric Corp. This relay is designed to closely match the curves of rotor heating set forth in the revised standard for magnitudes of equivalent negative-sequence current equal or greater than 1.0 per unit.

Ends El Salvador Rumor

Compania Electrica de San Salvador will act as power distributing agent in the San Salvador area for energy produced at Lempa River hydro project now under construction. The announcement ended rumors in the city that the government of El Salvador would nationalize the company, a subsidiary of Montreal Engineering Co, which in turn is controlled by International Power Corp.


Transmission Voltages—January 1951
Extra high voltage transmission exists or is under construction
230 kv transmission lines exist or are scheduled to be built
230 kv or above under study but in indefinite stage

A 1952 Look at

Tomorrow's Transmission Voltages

The need for transmitting larger blocks of power has developed trends toward extra high voltages and also toward superimposing 230 kv on existing systems

P. L. **BELLASCHI**, Consulting Engineer, Portland, Ore.

To meet an expected doubling of power consumption in the next decade, greater transmission capability is needed. Tomorrow will also see higher transmission voltages with extensive 230-kv networks, 288 kv and 300 kv, 330 kv, and 345 kv, and also higher transmission units (see maps).

In the interest of standardization, the selection of transmission voltages and especially of basic insulation levels at the EHV's should be limited to a minimum in keeping with the overall technical and economic requirements.

In view of future interconnections it is of paramount importance that adjacent systems select the same voltage from the start, if possible.

Specifically higher voltage transmission systems will be needed on utility systems of the future to:

1. Secure increased transmission capability, commensurate with the future growth of generation and loading.

2. Maintain flexibility in basic transmission by super-imposing higher power transmission units on present networks commensurate with the rapidly growing system generation and load levels.

3. Superimpose systems above the present ones which are rapidly becoming in effect high-voltage distribution networks.

4. Attain increased transmission capability most economically.

5. Meet the growing difficulty in some regions in securing additional right-of-way facilities.

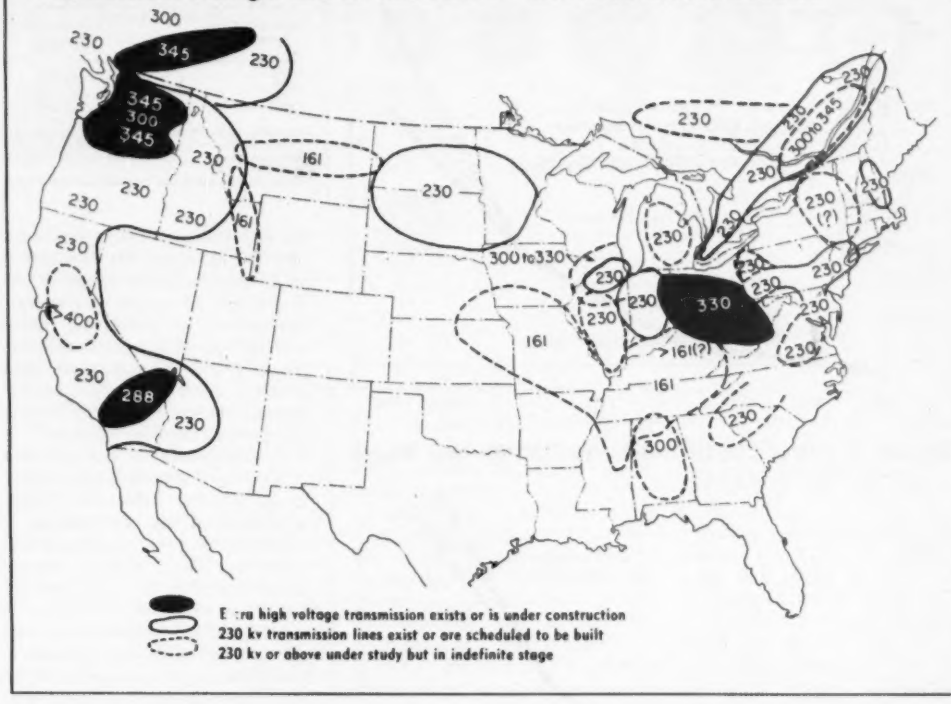
6. Integrate and coordinate with overall growth, load density and system interconnections.

Table I. Relative Power Capability vs. Transmission Voltage (200 Mile Line)

Transmission Voltage—KV	Relative Power Capability of Line*
230	1.00
300	1.60
345 (single)	1.98
345 (bundle)	2.39
380 (single)	2.25
380 (bundle)	2.72

* Power capability of 230-kv line with 500 MCM copper equivalent conductor is 210 Mw with 15% margin under stability limit.

Transmission Voltages 230 Kv and Above—Estimated Growth 1956-58


300
230
345
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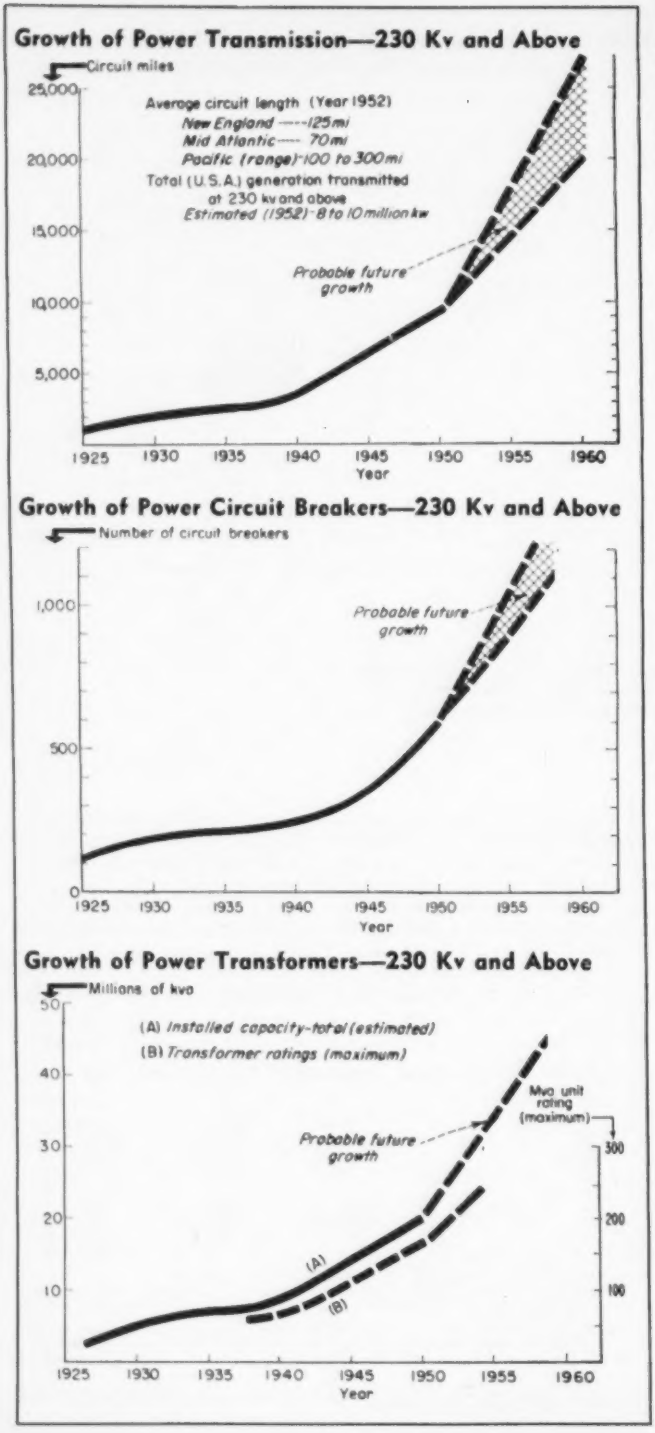


Table IV. Transmission Voltage Proportioned to BIL

Basic Insulation Level (75°) (KV)	Transmission Voltage (KV/RMS)
(975)	288/302
1050	308/322
(1175)	345/368
1300	380/400

Note: The table illustrates principle of proportioning voltage to BIL for condition of grounding attainable. The two voltage values refer to the nominal and maximum.

mission voltages. Where ice formation is a factor, the low resistance of large area conductors associated with higher voltages inherently presents a problem in ice prevention. Lower voltages may be favored in this case, unless special conductors are used. Voltages above 300-kv present hot-line maintenance problems because of the greater clearances involved.

Radio Influence . . . Radio influence is a principal limiting factor and unknown quantity, influencing the determination of type and diameter of conductor for EHV. Experience has shown that a 1 to 1.10 in. diameter ACSR conductor is satisfactory for 230-240-kv operation.

With this as a reference and with the field and laboratory research in recent years, a 1.38 in. diameter ACSR should be satisfactory for 300-kv operation and 1.60-in. ACSR solid or expanded for 345 kv. Above 345 kv single conductors become large and unwieldy, present difficult problems of handling, fitting and of ice prevention; besides they are inherently subject to streamer formation and similar effects.

Investigations abroad point to the use of bundle conductors for voltages above 345 kv. Bundle conductors offer in addition the advantage of 25% less reactance. But they have certain disadvantages, such as requiring heavier tower construction, inherent mechanical complications, possible risk of conductors sticking, etc. Bundle conductors likewise present problems of ice prevention. In Sweden a bundle-conductor design of two 1.25-in. diameter ACSR has been adopted for 380 kv operation.

Corona . . . Corona losses are not a determining factor because on an annual basis they are only a fraction of the I^2R losses, even at EHV. Under adverse atmospheric conditions corona losses can be very high, but these conditions occur for only a fraction of the total operating time.

Table V. Reduction in Cost of Transformers and Improved Performance Realized By Reduction in BIL

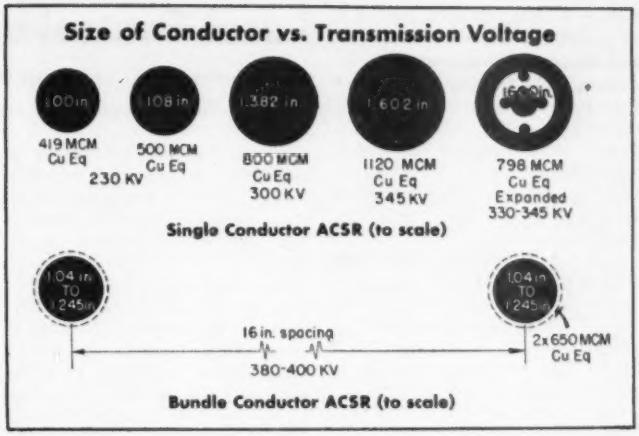
	1050 BIL	825 BIL
Cost	100	75-80
Impedance	100	80-85
Weights, Dimensions, Shipping Weights		Reduced
No Load Losses, Copper Losses		Reduced

The factors that affect radio influence and dielectric performance at EHV are complex to the extent that experience alone can establish the very top economic and permissible voltage for a particular system. In planning for higher voltages, transformers at the terminals should also be equipped and designed so that possibilities of higher operating voltages can be capitalized to advantage in case operating experience with the line conductor selected so indicates.

Insulation . . . Insulation is a major cost factor in line and terminal equipment operating at EHV. On an ungrounded 230-kv system, full 1,050-kv insulation would be required. On an effectively grounded system in which 60-cycle overvoltages due to load dropping and to system faults are not to exceed about 125% of normal line-to-ground, and switching overvoltages three times, 80% arresters are permissible and correspondingly 80% BIL is applicable.

On a solidly grounded system 60-cycle overvoltages would be held under 110 or 115% normal line-to-ground, and with the application of breakers of good behavior and no restrike, switching voltages limited to less than 2½ times. In this case, 75% arresters are applicable and correspondingly a BIL of 825 kv can be specified. The definition and application of 80% and 75% arresters are indicated in Table III. To utilize the insulation to the fullest, a basic approach would be to proportion the transmission voltage to the BIL for the conditions of grounding prevailing (Table IV). In the event system conditions permit the application of 70% arresters, then correspondingly lower BIL's should be possible.

The degree of grounding is determined essentially by the 60-cycle dynamic and system transient overvoltages developed in relation to the minimum rating of the arrester or protective device that it is safe to apply.



It is a foregone conclusion that in planning EHV systems every effort will be directed to securing a high degree of grounding.

In addition to the reduction in cost of equipment resulting from a reduction in BIL, other tangible benefits are the improved characteristics and performance, paring down of weights and dimensions, and especially the lower impedance realized Table V. It is well to note that a 1% reduction of transformer impedance corresponds in impedance value at 300 kv to about the equivalent of 9 miles of line considering the two terminals. The actual economic value would be less but nevertheless quite tangible. To further illustrate the point,—in terms of series capacitor compensation a reduction of 1% impedance for a 360/480/600 Mva, 345-kv transformer bank is the equivalent of 10,000 kvar of series capacitors. For the two terminals the total corresponds to 20,000 kvar.

Factors Influencing Future Transmission . . . Viewing current developments and trends from an overall vantage point, we find on the one hand the need for higher transmission capabilities and the urge for more economical transmission of large blocks of power, both attainable through the use of higher voltages. On the other hand, technical advances and developments now make possible higher power capabilities and economies in the amounts required for many cases, without recourse to the very high voltages. Such factors are for instance, series compensation,

Table VI. Proposed Power Transmission at Extra-High Voltage

Country	Voltage	Conductor	No. Insulators 5¾ in. or Equiv.	Phase-to-Phase Spacing, Feet
U. S. A.				
S. W. Pacific	288	HH-Copper 1.40" (in service)	21	24.5/32.5*
N. W. Pacific	300	ACSR 1.382"	16	26.3
N. W. Pacific	345	ACSR 1.602"	18-19	26/32.7*
East N. Central	330	ACSR 1.600" (expanded)	18	21.5/35.6‡
Canada				
British Columbia	345	Bundle ACSR 2 x 1.11"	21	35
Sweden	380	Bundle ACSR (in service) 2 x 1.25"—18" spacing	23	39
France	380	Bundle ACSR and Single ACSR	——	40
England	275 (300)	Bundle ACSR	——	——
Germany	300	HH-Copper 1.65"	——	——
Italy	>230 (future)		——	——
Switzerland	>230 (future)		——	——
Russia	400	Bundle ACSR 3 x 1.19"—16" spacing	22 (7¾" units)	40
Australia	>300	——	——	——
South America	230	ACSR	——	——
Mexico	230	ACSR	——	——

* First Figure Refers to Vertical—Second to Horizontal Between Conductors.
‡ First Figure Refers to Vertical Between Conductors—Second to Horizontal Between Circuits.

further development and application of bundle conductors, the relative economies of double and single circuit lines, design application of rapid clearing and reclosing breakers in combination with new and improved systems for control and communication, more rational application of reactive system design, not to mention some of the other factors already discussed.

Therefore, 230 kv has definitely not been relegated to secondary importance in future power transmission in the U. S. Conversion of some of the present 161-kv, 138-kv, and even 115-kv lines to 230-kv operation is more than academic. In one instance, 161-kv ACSR conductors were removed, sent to the factory for an additional layer of aluminum conductors, and then restrung for 230-kv. Adapting bundle conductors to existing 115-kv, 138-kv, and 161-kv circuits for 230-kv operation is another possibility.

With the great volume of 230-kv expansion planned for the near future, it can be expected that still more technical advances directed to more economical and functionally more effective 230-kv line design will be made to further the application of 230-kv.

Where economic and technical requirements dictate higher transmission voltages, these will naturally find application. The trend in this direction already is quite impressive. In fact, as indicated in the tabulation (Table VI), the rush for EHV's seems to be underway, one country out-doing the other so-to-speak.

Conclusions . . . Three definite conclusions stand out conspicuously:

1. A nation-wide trend to 230-kv transmission superimposed on present 138-kv and 115-kv systems.

2. The importance of 230-kv and higher transmission voltages in the future economic power development and growth in the U. S.

3. A development of higher transmission at 288-kv and up throughout the world.

Author's Acknowledgement: The author has been associated with Bonneville Power Administration since June 1948 in a consulting capacity on high voltage power transmission and related system engineering studies and has drawn in good part from this background of experience in the preparation of this article. In addition he is indebted to many transmission and system engineers throughout the U.S., Canada, and abroad for the information presented in accompanying maps and charts and in Table VI. The 1951 map is based on publications and charts made available in 1951 from the Federal Power Commission.

Local Control of Reclamation...

. . . is advocated strongly at National Reclamation Association meeting. Straus urges more local responsibility

Greater state and local control over reclamation projects was the main theme of the 21st annual convention of the National Reclamation Association held recently at Long Beach, Calif.

The theme recurred in resolutions passed by the convention, in speeches by NRA Pres C. Petrus Peterson and other officials, speeches by political figures such as Sen William F. Knowland of California and Gov Dan Thornton of Colorado, and in the address by U. S. Commissioner of Reclamation Michael W. Straus.

Inherent Right . . . As Thornton put it: "Local governments have the inherent right to fix the policies of western reclamation, not the servants of federal bureaus 3,000 miles away."

Knowland criticized the sometimes "motherly attitude" of Reclamation, "which seems unable to cut the apron strings and let its projects grow up, and unable to bring projects to quick completion."

Knowland urged cooperation between the western reclamation states. They must, he said, "present a united front in Washington. They must consolidate their positions and work together before presenting their requests to the federal government."

He referred to the California vs Arizona controversy over Colorado River water, and said: "All of us should be seeking areas of agreement, rather than disagreement. We should negotiate; then, failing there, arbitrate; and if that fails, go to courts for decisions."

Local Responsibility . . . Commissioner Straus also referred to the California-Arizona battle in a speech that emphasized the responsibilities of local governments.

"The Bureau of Reclamation not only agrees to more local control and local responsibility, but insists upon it," Straus said. "And right now is the time to begin—not on any put-up-or-shut-up basis, but with a serious and consistent program under which the localities and states will pick up and carry some of the burdens your Reclamation Bureau has had to bear, frequently by default, for you."

Referring to proposals that California take over and operate the Central Valley Project, Straus said he was emphatically for it, but cautioned that any plans along that line must be realistic and take into consideration estimates that it would cost California close to $4 billion in the next 50 years to buy existing CVP works and complete the comprehensive plan.

Outlines Program . . . Straus said that the bureau will present to the next Congress a six-year reclamation program which would cost some $2.1 billion, provide irrigation for 3,110,000 acres and additional generation capacity of 2,866,000 kw.

In a general review of the status of reclamation on its golden jubilee, NRA President Peterson also called for more local control, and spoke of such conflicts as that "between those who visualize the federal government as the owner and operator of the electric utility installations in perpetuity and those who believe that the ownership of the electric distribution facilities would become vested in local agencies when costs of construction are paid."

Stand on Reclamation . . . The convention adopted 36 resolutions. Among the most important stands taken were these:

The association reaffirmed its opposition to valley or regional federal authorities. It also opposed the proposal of the President's Water Policy Commission "to superimpose layer upon layer of commission organization." As the proper alternative for interstate basin-wide developments, it came out for the interstate compact, combined organization of state and local interests with the federal government, "these coordinated in voting authority."

Other Resolutions . . . In other resolutions, NRA:

- Came out for sale of power from federal developments at the generating point, wherever possible, and avoidance of duplicate transmission lines.
- Urged greater local discretion in contract terms.
- Urged amendment of the federal

power act so that states or state agencies no longer need file with the FPC a declaration of intention to construct a power dam across a navigable stream, unless the department of defense first determined the dam would adversely affect the actual navigability of the stream; and that whenever a declaration of intention is necessary and a license issued, the license should contain no provision for recapture by the U. S. of such publicly owned projects.

• Opposed the Hoover Commission recommendation that the civil functions of the Army Corps of Engineers be incorporated into the Department of Interior.

• Urged that the Secretary of Interior be authorized to grant loans of interest-free money to local districts for construction of local distribution systems, which may be less costly than projects designed and constructed by Reclamation.

Sepa Plans to Start Work on Line Halted by Court

Southeastern Power Administration's plans to proceed with construction of a 41-mile long transmission line from Clark Hill Dam to Greenwood, S. C., were halted Nov. 18 by a restraining order issued in Superior Court.

Duke Power Co and South Carolina Electric & Gas Co petitioned for the order. They claimed Charles W. Leavy, Sepa administrator, had entered illegally into a contract with a construction firm to build the line without first negotiating with utilities over possibilities of wheeling the power over private lines.

Congress stipulated at the time it appropriated funds for the Sepa line that every effort must be exhausted to reach a wheeling agreement with the utilities before Sepa could build its own line.

The two utilities were required by the court to post bond to cover any damages which might occur as a result of the delay in building the line.

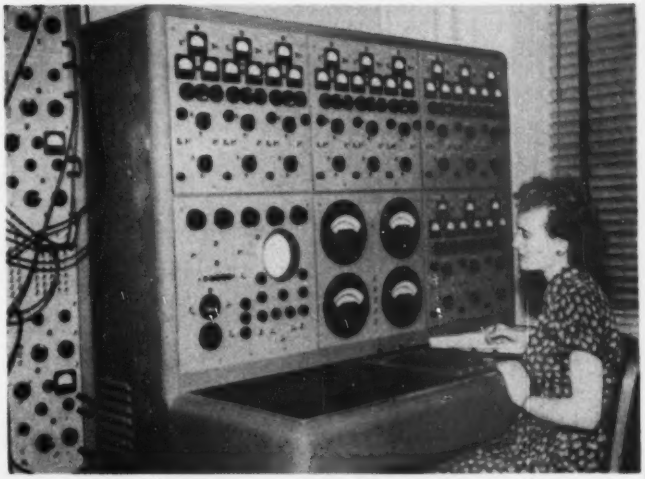
The first generator at Clark Hill is expected to go on the line soon. A service unit is now in operation.

Saline Water Research

The Office of Saline Water Research Coordination, Interior Department, is inviting all organizations or individuals interested in the development of methods of conversion of sea water and the demineralization of brackish water for beneficial uses to participate in the initial phase of its program.

The objective of the current program, authorized by the 82nd Congress, is to coordinate and stimulate research and development of economically feasible processes by which saline waters of all kinds may be made useful for municipal, industrial, irrigation, and livestock uses.

First phase of the program consists of making an inventory of past theoretical and practical developments in the field.



Network Analyzer of New Design

Long Island Lighting Co's network analyzer, incorporating new design features, has been in operation since July. It is shown here with Miss Ann Beveridge, one of the operators, at the control desk.

The equipment includes 12 generators, 140 lines or loads, electronic metering, and push button selection of the element to be metered. The analyzer operates at 60 cycles ac directly from a 3-phase 120/208 v supply. Manufacturer of the analyzer estimates the cost to be about one-third that of convention designs.

Sues on Fishing Rights

Chief of the My-am Indian tribe in Oregon has filed suit in U. S. District Court for $20,000 for damage to properties to be flooded by The Dalles Dam reservoir on the Columbia River. Many other suits are expected unless negotiations on Indian fishing rights can result in agreement. Pacific Northwest tribes traditionally have taken salmon in the Celilo Falls area and the waters have been reserved to the tribesmen by a century-old treaty between the Indians and Congress.

In Aluminum to Stay, Utility Man Tells AIEE

"We are in aluminum to stay," Horace Mac Vaugh, Philadelphia Electric Co, told the New York Section of American Institute of Electrical Engineers in a recent symposium on aluminum conductors and connectors. Starting in February of this year, he said, his company has installed 2 million ft of aluminum and ACSR conductors. Their program now calls for stringing more than 400,000 ft a month.

At the Levitt project of 16,000 homes near the new Fairless steel mill of U. S. Steel in Morrisville, Pa, aluminum was used extensively. The distribution system has aluminum for sub-transmission, primaries, and secondaries. Aluminum service entrance cable extends from the poles to the meter sockets. Street lighting poles and cable are also aluminum, he said.

No difficulty has been encountered in construction or in subsequent operation, Mac Vaugh said. In spite of the greater care required to make and tape the joints, linemen expressed pleasure at the ease of stringing the long runs of conductor.

PULLING ALUMINUM CABLE over booster blocks and into rings on galvanized messenger cable which is 27 ft above ground

A 90-DEG BEND on messenger is made by using a split 4-in. steel pipe as a guide to insure proper radius for the cable

How Consolidated Edison Installed

New York's First Aluminum Cable

First planned 27-kv feeders installed both overhead and underground. Overhead sections pulled in 1000-ft lengths; spliced from tower trucks. Copper design policies followed

A. F. NEWMAN, Engineer and

F. J. JOHNSON, Engineer
Consolidated Edison Co of New York, Inc

Installation of a 27-kv, 3-conductor, aluminum 4/0 compact-sector lead covered cable has recently been completed on the system of Consolidated Edison Co of New York, Inc. This initial installation on the Con Edison system consists of approximately 32,000 ft underground and 14,000 ft overhead. A second installation is planned.

In specifying this aluminum cable engineers followed the same design policies as they have used for copper cable. No difference was recognized between the new cable and those previously used except that 4/0 aluminum conductors were substituted for 2/0 copper conductors.

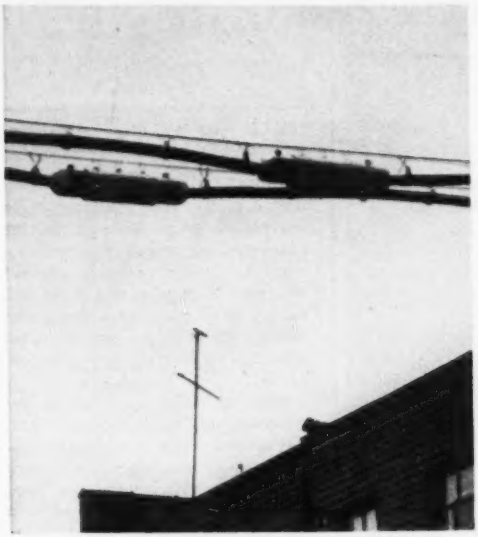
Overhead Section . . . Overhead runs of the cable are installed on galvanized steel messengers with rings and saddles, 27 ft above the ground. This height provides clearances of 40 in. below the secondary racks and 18 ft above ground at mid-span. Where there are two cables they have been attached at the same level but on opposite sides of the pole, to keep from increasing the pole heights.

The cable was pulled into the rings in sections approximately 1,000 ft long. Section lengths were determined by the size of the reel that could be handled conveniently in city streets.

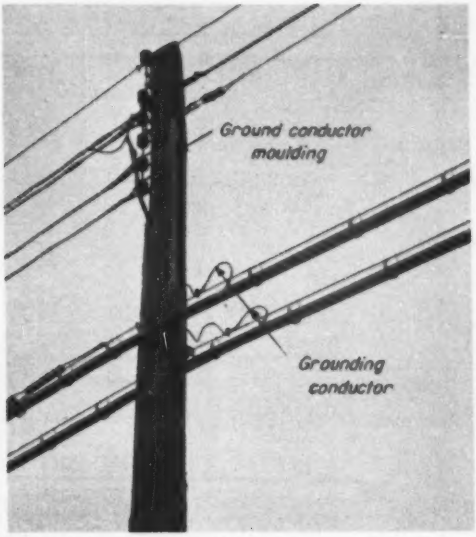
Splices were made from a tower truck so that it was not necessary to have splices near a pole. Before cutting the cable for splicing, temporary grade clamps were installed on both side of the joint to prevent excessive cable movement due to temperature changes while the joint was being made. The clamps were removed after the joint was completed.

The overhead joints are supported by zinc straps over a split transite sleeve. These straps are attached to the messenger so as to allow for longitudinal movement of the joint.

As the coefficient of expansion of aluminum is about double that of steel the relative lengths of the cable and messenger change with temperature variations. Installation of grade clamps at intervals of 500 to 700 ft insure even distribution of the excess cable length under high temperature conditions. Arsenical lead sheaths were used on the cable to withstand the movement due to swinging in the wind and temperature changes. Grade clamps were also installed on both sides of 90 deg bends so that the expansion of the cable will not cause bending below the allowed minimum



COMPLETED JOINTS on overhead lines are supported by zinc straps over split transite sleeves to allow for longitudinal movement



TYPICAL BONDING LOCATION where messenger and lead sheath are bonded to secondary neutral (no primary neutral existing here)

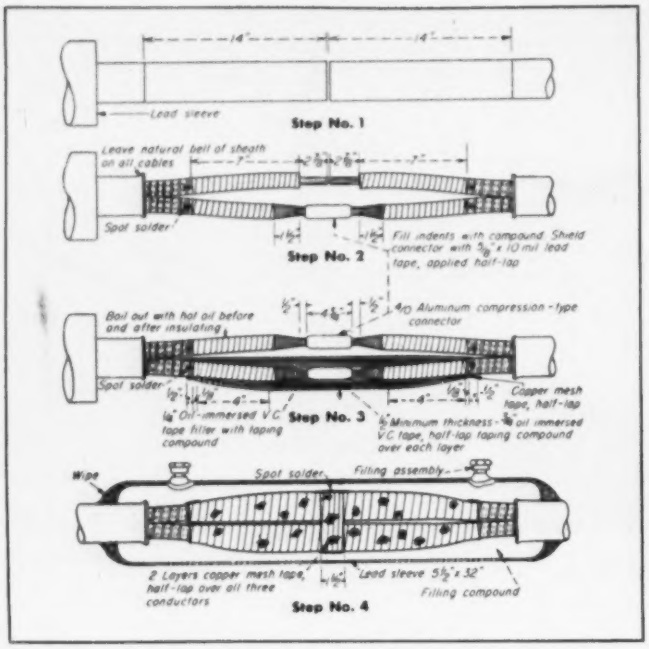
bending radius of the conductor.

Both messenger and lead sheath are bonded to primary and/or secondary neutrals at not less than two points for each cable section. However, the distance between two grounds is not permitted to exceed 800 ft. The grounding conductor is 2/0 stranded copper sweated to the lead sheath and clamped to the messenger.

Underground Section . . . Methods of installing aluminum conductor cable underground were similar to the installation of copper conductor cable. Two types of pulling bolts were used on the cables. Some were soldered to the aluminum conductors; others were a pressed type attachment. Soldered bolts were used only on sections where low pulling tensions was expected. The pressed type bolts were used on the longer sections. For further installations pressed type pulling bolts will be specified throughout in order to have a uniform design.

Conductor temperature variation is expected to be about the same as for copper conductors, but the expansion will be greater because of higher coefficient of expansion of aluminum. This expansion will be taken up in rectangular manholes 11 ft 6 in. long and 4 ft 6 in. wide with the joints offset from the duct centers.

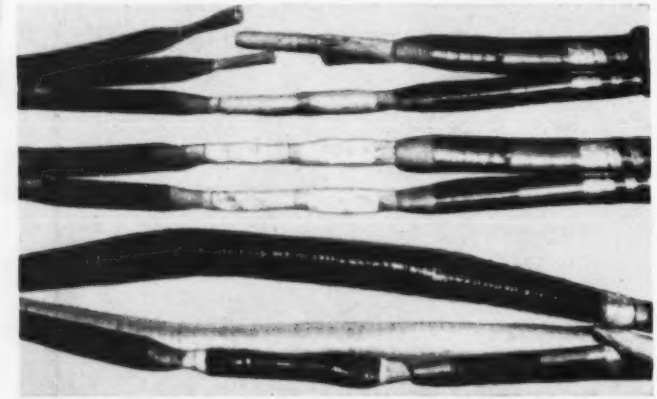
4/0 ALUMINUM JOINT being constructed. Two connectors are in place over cable ends. Third connector is ready for insertion on last conductor. Cotton tape is wrapped over paper insulation to prevent contamination with grease type corrosion inhibitor.


Lead sleeve
Step No. 1
Leave natural bell of sheath on all cables
Spot solder
Fill indents with compound. Shield connector with 5/8" x 10 mil lead tape, applied half-lap
Step No. 2
Boil out with hot oil before and after insulating
4/0 Aluminum compression-type connector
Spot solder
Copper mesh tape, half-lap
1/4" Oil-immersed V.C. tape filler with taping compound
Step No. 3
Minimum thickness 5/8" oil immersed V.C. tape, half-lap taping compound over each layer
Wipe
Spot solder
Filling assembly
2 Layers copper mesh tape, half-lap over all three conductors
Lead sleeve 5 1/2" x 32"
Filling compound
Step No. 4

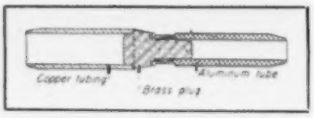
4/0 ALUMINUM JOINT for aerial use is the same as for underground use with the exception—latter uses oil instead of filling compound and oil reservoir connection is provided

Aluminum Joints . . . Big problem in the use of aluminum was making satisfactory connections to it. One of the considerations in a joint for a three-phase cable was that it shall not be excessively long in order to hold to a minimum the amount of retaping required and the length of the lead sleeve needed over the joint.

In this application aluminum connectors were used of sufficient length to take four indentations, two on each cable end. A barrier at the center of the connector serves two purposes; first, it permits each conductor to be inserted the proper distance into the connector, and second, it serves as a pump to force a corrosion inhibitor with petrolatum base, that is put into the connector previously, around and between the conductor strands as the conductor is inserted into the connector.



REDUCER joint fabrication of 4/0 aluminum (left) and 500,000 cir mil copper (right) conductors. (Top) One set of conductors ready for reducer, second set has a reducer preparatory for connection, third conductor is joined. (Center) Two reducers have been compressed and indented. (Bottom) One conductor is insulated and ready for shielding tape, second (light) is finished and third has reducer insulated.



REDUCER used for joining 4/0 aluminum and 500,000 cir mil copper cables

Since the connector is tubular and the conductors are compact sector, it was necessary first to round the conductor before inserting it into the connector. The indentations are then made as if the conductors had been concentric stranding.

Both aerial and underground joints were insulated by the same method. They differ only in that the overhead joint is filled with a compound that hardens and the underground joint is filled with oil. Each underground joint was provided with a connection to an oil reservoir.

Aluminum-Copper Reducers . . . Special aluminum-copper reducers were used where the 4/0 aluminum cables tie to the 500,000 cir mil copper cables. The latter cables also supply other loads.

At the load end, each 4/0 aluminum cable is tied to 2/0 copper cable with another copper-aluminum reducer joint similar in construction to the one mentioned above.

The reducers are indented on the cables in the same way as the straight connectors. The aluminum cable fits into the aluminum side of the connector and the copper cable into the copper side.

By the use of these reducers the necessity of designing potheads and other terminations are eliminated thereby making it possible to meet the service date for these overhead and underground feeders.

Hydraulic presses used to apply these connectors are the same devices used for copper. However, since the wall thickness of the aluminum connectors is greater than for copper connectors of the same conductor size, special nests and indenters are provided.

PUBLIC RELATIONS & ADVERTISING

Ohio Edison Uses

. . . Filmosound equipment for 'annual report.' Total cost of color picture with sound will be $4,000 with projector

A movie "annual report" that may be the forerunner of others is being prepared by Ohio Edison Co. By the end of the year 24 sequences, taken at the rate of two a month, will be ready. They will be edited, some animation and titling added, a script written, and then all will be combined into one full color, sound motion picture.

Sequences thus far photographed include construction work at two power plants, a company-sponsored cooking school, a tour of a Light Conditioned house, aerial movies of several power plants, and shots of representative activities of the company.

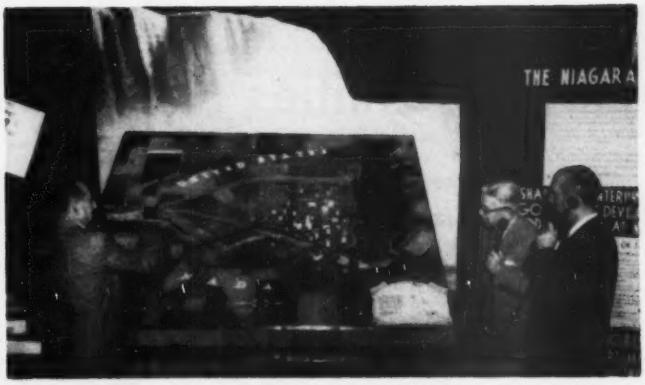
The cost of the completed film will be kept within a budget of $4,000. This includes the cost of special projection equipment, of taking and processing the movie, editing, titling, some animation involving art work, and the cost of talent and music in recording sound onto the film.

"While the completed movie will not have all the polish and special effects of some of the more elaborate sound films that have been produced for industrial relations departments," L. C. Panning, general supervisor of publicity, says, "still it will be of such a professional calibre as to be readily acceptable to almost any group."

For the project Ohio Edison is using Filmosound, a system employing equipment made by Bell & Howell, Chicago. Using any 16-mm silent film, a special print is made with a magnetic tape stripped on the side of the film ordinarily carrying the sound track. This stripping is done by the manufacturer at a cost of 3½¢ a ft—about $26 for a 20-minute movie.

All of the equipment necessary to transcribe sound onto the magnetic taped film is contained in the special projector, which also shows the film. In adding sound the film is run through the machine, and recording is done exactly as on a tape recorder. This special projector, costing approximately $700, is also equipped to show movies with conventional sound tracks and thus eliminates the need for duplicate machines.

Sound can be as elaborate or as simple as desired. A simple narration on a film is practically negligible in cost. Background music and special effects in themselves increase costs. The actual job of recording sound on the film can be done by anyone who can handle a tape recorder. And as is the case with a tape recorder, sound can be wiped off and new sound substituted.



Leaders of the Industry and . . .

Wisconsinites Hear about Niagara

The five-companies "More Power from Niagara" exhibit has now been seen by over 2 million persons in nine states. In the coming months millions more will see it.

The exhibit consists of a model of the Niagara power project as the five investor-owned companies in New York would develop it. But the gimmick which attracts the public is a set of telephones connected to a record player. Anyone can pick up a phone and get a one-minute message on the project.

In the upper picture J. S. Ackerman, Central Hudson Gas & Electric Corp, points out important details on the map as George M. Gadsby, former president of the Edison Electric Institute, and Bayard L. England, institute president, listen to the message. In the lower picture George Marks, Consolidated Edison Co of New York, handles the explanation for visitors at the Wisconsin State Fair.

Electric Utilities Must Sell

Basic requirement for national welfare is an electrical industry kept strong by selling

B. L. ENGLAND, President
Atlantic City (N. J.) Electric Co

A great sales period is approaching. Manufacturers of appliances and equipment are preparing to increase their outputs by percentages that a few years ago would have been considered "up in the clouds." Our customers want all-electric homes, modernized factories, improved commercial premises, and better lighted streets. It is up to all of us in the industry to sell our service more abundantly.

By mass selling methods we will be able to offset increased selling costs, and thus we will be able to meet our objective of providing service at the lowest possible rate levels. Not to be forgotten, our major sales effort will be among domestic, small commercial, and street lighting customers. The results attained will do much to maintain stable earnings for us through any possible recession in the days ahead.

Selling is, has always been, a major responsibility of the electric utility—selling its service to the customers on its lines and itself to the communities in which it operates. These two sales tasks go together. By selling our service a great good is rendered our customers in that a better standard of living is provided for them and production is increased in the factories and other business places in which they work. This results in a friendly and mutually appreciative relationship between the utility and the people it serves.

This is the basic reason why we in the Atlantic City Electric Co feel justified that we did not to any extent reduce our sales organization in the past when equipment was scarce, that we are now increasing our sales organization, and that we look to further increase in the years ahead.

Essential to National Security

The report of the President's Materials Policy Commission issued just a few months ago (June, 1952) is worthy of thoughtful study. Significantly, it is entitled "Resources for Freedom". It states that an adequate supply of electricity is a major part of the foundation for national growth and security. It also states the industry's job to be:

"**(1)** To expand generating and distributing capacity at a rate rapid enough to meet the growing electric demands of consumers in all areas of the nation.

"**(2)** To hold the real cost of electricity down to the lowest possible level.

"**(3)** To meet the electric needs of national security."

We think our company is doing its share in meeting these objectives. Most other power companies also have the right to be proud of their accomplishments. The one activity that makes this a certainty for any utility is selling continuously. Increased sales make it a necessity to expand all facilities at a rapid rate and in fact, make expansion a routine function. Mass selling keeps down the cost of service to a low level with present rate structures—too low in many instances. The ability to expand in our stride and finance the expansion by satisfying the money market that we can rapidly increase sales along with the expansion, is also the ability to meet the electric needs of national security. These needs were met in World War II when power was never "too little or too late."

National security requirements are being met today in supplying large blocks of power to the Atomic Energy Commission, as well as meeting all requirements for military installations as a matter of course. Our contribution along this line is particularly important now as we look ahead to the time when our civilian economy must fill in the gaps which may be left by a declining defense economy.

In our company we have found a need for selling every day. The territory served by the company is divided into three distinct zones: resort on the Atlantic seaboard; agricultural in the center of Southern New Jersey; and industrial along the Delaware River Valley. It was our sales task to do something about the summertime peak loads created by the great amusement and health facilities of the resort area. These have gradually been balanced by winter-

time peak loads created by industry and its associated small commercial and residential concomitants. This balancing process was not accidental. It results largely from the activities of a "Board of Directors" of local business and professional men who, in characteristic competitive fashion, actively sell the advantages of the area. Now our winter and summer peak loads are about equal. The resort revenue has changed from a proportion just a few years ago of nearly 60% of the total to about 30%, the non-resort revenue today approaching 70% of the total.

Our policy has always been to pioneer in sales until customer acceptance is established and then to rely on other agencies to carry on with our aid. We see no reason after over 30 years' experience to make a change even though pioneering appliances many times required subsidies to establish acceptance. We are continuing this policy today on electric clothes dryers. In the early '20's need for an active sales effort was realized, and a "Packaged Wired Kitchen" was initiated. Our sales organization sold this lighting plan installed and financed it for the customer. And we gave a percolator and iron to each wired kitchen.

Must Build Up "Stable" Revenue

Promotion of the residential load has always been foremost in our company mind. We agree thoroughly with the thought contained in the quotation from a speech by Clarence Linder, on this page. There is an enormous potential market in residential service. And there is no question of the extreme importance of aggressive development of this load in order to reverse the trend which has produced the radical change for the worse in the ratio of "stable" versus "unstable" revenue.

There are now on our lines some 300 homes heated exclusively with glass panels. These homes are generally in the $12,000 to $14,000-and-lower price class and there is quite general satisfaction with this type heat. About one half are seasonally occupied which provides an ideal installation. In addition, there are several hundred installations of panels as supplementary heating devices. We feel that this is a load deserving of our backing from a financial standpoint, so we are actively promoting it in the seashore zone.

Coincident with our company's efforts in the residential field, selling to commercial, industrial, and farm customers was started early and has continued without curtailment. Organized promotion of lighting in all applications, including streets and highways, of commercial cooking, and of other services is continuous.

Some of the results of this consistent selling: Today we have about every other home cooking electrically (46%), and every fourth home heating water electrically (27%). Our present average annual residential use of 3,000-kwhr, much above the industry average, was set as a bogey for 1955 several years ago. The first ten months of this year saw 5,200 kw added from commercial cooking sales. Our average annual farm use of 4,800 kwhr is 70% above the industry average.

We believe that in developing the industrial market the electric utility company should consider its mission more broadly than merely as the supplier of electricity. The industrialist usually considers his needs to be electric power, steam or other heat, and water. If the electric utility company supplies him with only one of these, he must secure the other two elsewhere. If a favorable heat balance is possible, the utility is under an extreme handicap in competing with a back-pressure or extraction turbine and frequently must cut the price below a rate of reasonable return if it is to meet this competition.

The co-operative arrangement* between the Atlantic City Electric Co and duPont Co at Deepwater and at Gibbstown, where duPont rents steam and power generating facilities and reimburses the electric company for operating costs, is an example of the way an electric utility company can provide all these needs of an industrialist to the mutual advantage of both parties.

If this or some similar method is generally followed by all electric utility companies, they will join with the industrialists in developing the necessary electrical capacity of the country on the most economical basis and will be making a substantial contribution to the complete electrification of the country with all of its inherent advantages and economies.

I believe that as selling is the big job ahead for our company, so also it is for all electric utilities, for every branch of the electrical industry. Not otherwise can the industry contribute its necessary share to our nation's "Resources for Freedom".

* See Electrical World February 11, 1952, p 94.

"To Live Electrically . . .

"To live electrically, a family must have in addition to good lighting a water heater, range, room air conditioner, clothes dryer, food freezer, electric sink, refrigerator, ironer, and automatic washer in the home. These appliances, listed in the descending order of their electricity consumption, requires 8,140 kwhr annually under normal usage.

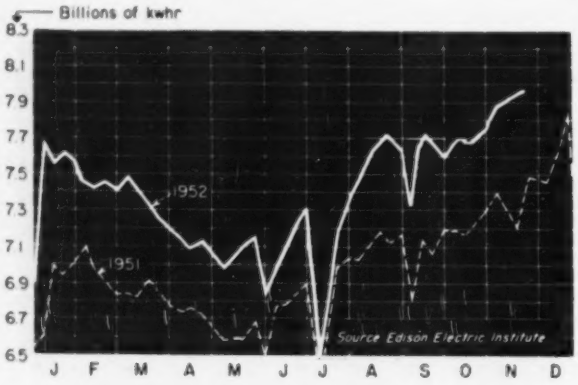
"The average annual kilowatt-hour consumption of electricity for each of the various major appliances is as follows:

Water heater	4,200
Range	1,080
Room air conditioner	1,000
Clothes dryer	600
Food freezer	480
Electric sink (including dishwasher and garbage disposal)	360
Refrigerator	264
Ironer	120
Automatic clothes washer	36
Total	8,140

"Six of these require more electricity than the average refrigerator. Four of the six, including the water heater, the room air conditioner, the dryer, and the freezer, help flatten out the utility load curve and thus raise the load factor to permit the more effective utilization of the electric utilities investment."

Clarence H. Lindler, General Electric Co, in a recent address to the New York Society of Security Analysts.

STATISTICS



Output Week Ended Nov. 22—7,971,149,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Nov. 22	+11.4	+23.1	+10.5	+13.8	+12.4	+10.6	+13.9	+7.3	—4.7	+13.9
Nov. 15	+7.5	+14.9	+6.2	+7.0	+7.3	+10.8	+7.9	+6.4	—4.2	+11.0
Nov. 8	+5.6	+11.6	+3.4	+4.9	+6.7	+7.4	+10.1	+6.3	—4.4	+8.4

Electric Power Statistics

Peak Load (Million Kw)	Aug.	69.7	67.2	64.3
Capacity (Milion Kw)	Sept.	78.78	78.31	74.29
Production (Billion Kwhr)	Sept.	33.38	34.36	30.25
Hydro		7.36	8.52	7.03
Fuel		26.02	25.84	23.24
Fuel Consumption				
Coal (Million Tons)	Sept.	8.82	8.57	8.60
Oil (Million Barrels)		6.03	5.38	5.06
Gas (Billion Cu Ft)		97.37	104.97	77.34
Sales (Billion Kwhr)	Aug.	29.39	27.70	27.45
Residential		7.53	7.50	6.50
Commercial		5.46	5.30	4.90
Industrial		14.10	12.64	13.83
Other		2.30	2.25	2.23
Net Income Class A & B Companies ($ Million)	Sept.	73.12	68.67	58.95
Estimated Dec. 52 Peak (Million Kw)	Aug.	80.0	80.1	79.7
Kwhr per Residential Customer (12 Month Average)	Aug.	2,119	2,104	1,947
Revenue per Kwhr Residential Service (12 Month Average)	Aug.	2.77¢	2.78¢	2.83¢
Canadian Production (Billion Kwhr)	Sept.	4.99	4.97	4.41

Business Statistics

FRB Industrial Production Index†††	Sept.	228	218	223
Gross National Product Annual Rate ($ Billion)	3rdQtr.	344.0	343.2	337.1
E. W. 5 Industry Production Index	Sept.	123.5	120.5	123.5
ENR Construction Cost Index††	Nov.	121.1	120.7	114.7
BLS Consumer's Price Index	Oct.	190.9	190.8	187.4
NEMA Insulation Materials Sales Index†	Aug.	451	470	539
NEMA Electric Appliance Sales Index†	Aug.	236	234	210
NEMA Household Refrig. Sales Index†	Aug.	148	197	97
Metal Prices, (Nov. 24)				
Copper, Conn. V., lb		$.24½	$ .24½	$ .24½
Lead, N. Y., lb		.14	.14 1/5	.19
Zinc, prime Western E. St. Louis, lb		.12½	.12½	.19½
Tin, Straits, qual. N. Y. lb		1.21¼	1.21¼	1.03
Aluminum, ingot, base price		.20	20	.19
Nickel, base price		.56½	.56½	.56½
Steel, billets, Pitts., ton		59.00	59.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		45.00	45.00	45.00

* Estimated. † 1936=100 †† 1949=100 ††† 1937-39=100 (Unadjusted)

UN Reports Energy Use Increasing 1.9% a Year

World production of all commercial sources of energy rose at the rate of 1.9% per annum between 1929 and 1950, to reach a total equivalent to 2,765 million metric tons of coal. Production and consumption of energy from non-commercial as well as commercial sources were equivalent in 1949 to approximately 3.1 billion metric tons of coal. These facts were revealed in a special report just released by the United Nations. (EW, Nov. 24, p 14)

Most of the world's fuel and power, the UN reports, was produced and consumed in the developed portions of the world. A striking distinction betwen developed and under-developed areas is their relative per capita consumption of energy. This ranged in 1949 from one-half metric ton coal-equivalent in Asia to more than seven metric tons coal-equivalent in North America.

Regional Shares of Fuel and Power

(Percentage of World Totals—1949)

	Production	Consumption
North America	37.2	38.2
Europe	24.8	25.6
Oceania	0.8	1.1
USSR	11.8	12.4
Africa	2.5	2.6
Latin America	6.2	3.7
Asia	17.0	14.2
Developed Countries	72.8	75.1
Underdeveloped Countries	27.2	22.7
Ship's Bunkers	——	2.2

Nearly half the world's energy was supplied by coal and lignite in 1949, while most of the remainder was supplied by non-commercial fuels and oil.

Two secondary sources of energy, thermal electricity and manufactured gas, received special attention in the UN study.

The world supply of electricty was equivalent in 1949 to 504 million metric tons of coal, while the supply of gas was equivalent to 306 million metric tons.

Hydro and thermal electricity thus provided 16.2% of all the energy consumed in 1949, natural and manufactured gas 10.1%. Together, gas and electricty represented 26.3% of the world's energy.

FINANCIAL

Puget's Sale Delayed . . .

. . . until Dec. 2 when Judge Max Church will hear objections to Kitsap County's participation in $94-million purchase plan

A court hearing on objections to the Kitsap County PUD's participation in the proposed $94-million purchase of the Puget Sound Power & Light Co has been postponed to Dec. 2 at Port Angeles.

The hearing was to have been held Nov. 24 at Port Orchard before Judge H. G. Sutton but was transferred to the jurisdiction of Judge Max Church when the PUD's filed a motion of prejudice against Judge Sutton.

Contempt of Court . . . The motion was filed on the basis of remarks Judge Sutton made to newsmen after the Kitsap PUD resolved to drop out of the proposed six-district purchase of Puget Power, leaving the other five PUD's free to proceed with the purchase. Judge Sutton thereupon commented that "the spirit of the restraining order definitely is to stay the purchase deal" and declared that he would cite the commissioners for contempt of court if they did anything to make their resolution effective.

Pro-purchase forces contend the actions of the Kitsap PUD did not violate the terms of Judge Sutton's order but Judge Frank W. Ryan, the second Kitsap County Superior Court Judge, signed an amended order with a more specific prohibition against any action relating to the purchase.

As a result, the Kitsap PUD can neither proceed with the other PUD's in the purchase nor drop out of the transaction. Accordingly, the entire transaction appears to be blocked until the court action can be resolved.

Commissioner J. W. Bryan Challenged . . . A second court action challenges the right of J. W. Bryan, leading opponent of the purchase, to hold office as a Kitsap PUD commissioner. Pro-purchase groups contend that Bryan is not a resident of the district from which he was elected two years ago. If Bryan should be disqualified and the pro-purchase opponent he defeated in 1950 should be seated, two of the three commissioners would be in favor of the purchase. Should the seat merely be declared vacant, the other two commissioners would be on opposite sides of the purchase issue.

Ralph Purvis, Kitsap County prosecuting attorney, has petitioned for a revocation of the restraining orders which block the sale or, in the alternative, that C. E. Ferguson, a foe of the purchase who takes office as a Kitsap PUD commissioner Dec. 1, be required to post a $5-million bond in place of his present $1,000 bond. C. Jack Jones, the incumbent whom Ferguson defeated Nov. 4, and T. A. Jones, the third commissioner, filed supporting affidavits, contending the bonds should be sky-high because, if the deal is blocked, they may face large suits for breach of the district's purchase commitments.

Kitsap PUD Will Profit . . . R. W. Beck, the consulting engineer who aided in drafting the purchase plan, testified in an affidavit that the Kitsap PUD alone would receive a daily net profit of $1,031½ above all costs and expenses, if it participates in operation of the power company's purchase properties.

Meanwhile, public power advocates look with foreboding to the 1953 session of the state legislature which convenes in January. The publication of the Washington State Grange, one of the leading organizations in the public power movement, commented editorially that "Private power people intend to so mutilate the public power program that it never again will be a threat to their plans for control of the Columbia River Basin's hydroelectric resources."

Two amendments to present laws would require elections upon PUD issuance of revenue bonds or initiation of a condemnation action, another would prevent districts from acting jointly in purchase of a power system, a fourth would bring the PUD's under jurisdiction of the state Public Service Commission while a fifth would provide machinery for the dissolution of PUD's.

NYC Acts to Raise Fees After Con Ed Boosts Rates

After Consolidated Edison Co of New York filed new rate schedules with the New York Public Service Commission asking for $2.6 million a year increase from New York City's Board of Transportation, the city countered with a proposition to increase its $1,143,000 yearly charge against the company for use of city streets for the utility's transformers.

Action Taken . . . Con Ed took the rate action even though it was negotiating at the time with a three-man city committee. The new schedules became effective automatically on Nov. 16 when the city's contract with the company expired. The company said it had to take this step as the law required some kind of rate schedule to be in effect.

Sidney H. Bingham, chairman of the Board of Transportation, declared "the increase is more than I expected." He hoped that negotiations would continue. He said he believed that, while the hike was effective automatically, Con Ed would be willing to give the city credit for any over-payments in case a lower rate was later agreed upon.

New York City's Controller Lazarus Joseph said he thought the street charge should be increased, regardless of the outcome of the rate case.

He revealed that in previous negotiations he had "discussed" a 25% rate increase as compared with 40% originally sought by the company. In the rates filed the company will get a 37% hike.

The controller pointed out that an appeal might lead to the city paying "considerably less" if the PSC should rule that the 37% increase was too much.

REGULATION

Columbus (Ohio) municipal light plant will ask a "substantial" rate increase from its industrial customers, Service Director Elmer A. Keller has announced. Despite this increase, he said, municipal rates will still be lower than those of Columbus & Southern Ohio Electric Co.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1952									
Nov. 20	**2.96**	**3.00**	**3.12**	**4.04**	**4.24**	**4.37**	**5.05**	**5.49**	**5.88**
Nov. 13	2.97	3.00	3.14	4.05	4.26	4.39	5.14	5.50	5.99
3rd 1952	2.99	3.03	3.16	4.10	4.26	4.61	5.18	5.59	5.96
2nd 1952	2.95	3.00	3.09	4.05	4.31	4.60	5.38	5.85	6.42
1st 1952	2.95	2.99	3.13	4.11	4.29	4.66	5.35	6.03	6.47
4th 1951	3.02	3.07	3.21	4.32	4.50	4.91	5.42	6.18	6.84

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months Ended		Net Income 1952	Net Income 1951	Earnings Per Common Share 1952	Earnings Per Common Share 1951
Alabama Power	12	Oct.	$11,771,524	$10,444,424	$....	$....
Carolina Power & Light	12	Oct.	7,000,937	6,321,751	....	....
Central Illinois Light	12	Oct.	2,874,389	3,038,203	2.64(a)	2.82(a)
Georgia Power	12	Oct.	11,833,570	9,051,710	....	....
Gulf Power	12	Oct.	1,718,224	1,126,609	....	....
Minnesota Power & Light	12	Oct.	3,326,393	3,269,102	3.20	3.13
Mississippi Power	12	Oct.	1,964,428	1,808,808	....	....
Montana Power	12	Sept.	7,267,276	6,595,463	....	....
New York State Electric & Gas	12	Oct.	7,322,410	5,984,577	2.32(b)	2.04(b)
North American Co. consolidated	12	Sept.	12,117,307	10,555,384	1.41	1.23
Ohio Edison, consolidated	12	Oct.	15,537,014	14,173,181	2.86(c)	2.66(c)
Pacific Gas & Electric	12	Sept.	44,706,778	36,225,832	2.49(e)	2.15(e)
Pennsylvania Power	12	Oct.	2,076,414	1,745,267	....	....
Southern Co. consolidated	12	Oct.	20,206,775	15,975,230	1.18(f)	.98(f)
Southern Indiana Gas & Electric	12	Oct.	1,831,018	1,739,289	2.07	1.94

Notes—(a) Based on 900,000 shares outstanding; (b) Based on 2,696,950 shares in 1952 and 2,396,950 shares in 1951; (c) Based on 4,798,460 shares outstanding; (e) Based on 11,924,245 shares in 1952 and 10,646,638 shares in 1951; and (f) Based on 17,076,669 shares in 1952 and 16,306,494 shares in 1951.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF NOVEMBER 20—26			
Bonds			
Gulf States Utilities—1st mtg 3¼% 1982	$10,000	$100.75	3.09%
Preferred Stock			
Commonwealth Edison—1,155,730 sh $25 par $1.40 cum. conv. (being offered commonholders on 1-for-12 basis, record Nov. 24 to expire Dec. 10)	$35,828	$31.00	4.52%
Common Stock			
Hawaiian Electric—50,000 sh (being offered commonholders on 1-for-10 basis, record Oct. 3 to expire Nov. 26; no underwriting)	$1,000	$20.00	10.00%*
WEEK OF NOVEMBER 27 TO DECEMBER 3			
Bonds			
Florida Power Corp—1st mtg 1982	$15,000	.....	.....
SCHEDULE FOR DECEMBER, JANUARY			Bid Date
Bonds			
Kansas City Power & Light—1st mtg	$12,000	.....	Jan. 20
Ohio Power—1st mtg	22,000	.....	Jan. 20
Iowa-Illinois Gas & Electric	8,000	.....	Jan. 27
Debentures			
Consolidated Gas Electric Light & Power—conv. 3¼% 1967 (being offered to commonholders on basis of $100 debenture for each 30 shares of common, record Dec. 1 to expire Dec.18)	$16,454	$100.00	3.25%
Preferred Stock			
Ohio Power—100,000 sh $100 par	10,000	.....	Jan. 20
Iowa-Illinois Gas & Electric—60,000 sh $100	6,000	.....	Jan. 27
Ohio Edison—150,000 sh $100 par	$15,000	.....	Jan. 13
Common Stock			
Cleveland Electric Illuminating—557,895 sh (being offered commonholders on 1-for-5 basis, record Nov. 24 to expire Dec. 10)	$24,129	$43.25	6.01%
Western Light & Telephone—65,168 sh (to be offered to commonholders on 1-for-5 basis, record Nov. 26 to expire Dec. 9)	1,434	22.00	7.27
Ohio Edison—479,846 sh (to be offered to commonholders on 1-for-10 basis, record Jan.7)	.....	.....	.....
UNSCHEDULED AND UNDER CONSIDERATION			
Bonds			
Central Maine Power—1st general mtg	$6,000	.....	.....
Toledo Edison—1st mtg	7,500	.....	.....
Central Hudson Gas & Electric—1st mtg	6,000	.....	.....
Common Stock			
Central Maine Power	$5,000	.....	.....
Toledo Edison—500,000 sh	.....	.....	.....

Notes—* Dividends are subject to 2% Hawaiian withholding tax. If this tax is deducted, the yield would be 9.80%.

CALENDAR

American Society of Mechanical Engineers
Annual Meeting, Statler Hotel, New York, Nov. 30-Dec. 5.

***Edison Electric Institute.**
Prime Movers Committee, Hotel Martinique, New York, Dec. 1-2; Commercial Lighting Committee, Netherlands Plaza Hotel, Cincinnati, Dec. 3-4; Industrial Power-Heating Section, Jung Hotel, New Orleans, Dec. 8-9; Cost Management Program Subcommittee, Sheraton Hotel, Pittsburgh, Dec. 10-11; Home Service Committee, EEI Headquarters, New York, Dec. 11-12; Accident Prevention Committee, Hotel Muehlebach, Kansas City, Mo., Jan. 12-13, 1953; Transmission-Distribution Committee, Shoreham Hotel, Washington, D. C., Feb. 12-13, 1953; Electrical Equipment Committee, Jefferson Hotel, St. Louis, Mo., Feb. 16-17, 1953.

50th National Power Show
Sponsored by American Society of Mechanical Engineers, Grand Central Palace, New York, Dec. 1-6.

Public Utilities Advertising Association
Winter Meeting, Region 2, Claridge Hotel, Atlantic City, N. J., Dec. 4-5.

Interstate Power Club
Hotel Martinique, New York, Dec. 8.

Institute of Radio Engineers
Joint Electronic Computers Conference with American Institute of Electrical Engineers, Park Sheraton Hotel, New York, Dec. 10-12; Joint High Frequency Measurements Conference with AIEE, Statler Hotel, Washington, D. C., Jan. 14-16, 1953.

Canadian Electrical Association
Eastern Zone: Engineering Division, Nova Scotian Hotel, Halifax, N. S., Jan. 15-16, 1953; Sales Division, General Brock Hotel, Niagara Falls, Ont., Jan. 22-23, 1953; General Division, Mont Tremblant Lodge, Mont Tremblant, Que., Jan. 29-30, 1953.

American Institute of Electrical Engineers
Winter General Meeting, Hotel Statler, New York, Jan. 19-23, 1953.

National Rural Electric Cooperative Association
11th Annual Meeting, Civic Auditorium, San Francisco, Jan. 26-29, 1953.

***National Association of Corrosion Engineers**
Short Course in Corrosion in cooperation with University of California, Berkeley, Feb. 2-6, 1953.

***Missouri Valley Electric Association**
Industrial-Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 5-6, 1953.

***Addition this week.**

FINANCIAL BRIEFS

Conroe, Tex., Public Service Co has been granted a 50-year charter to serve the area with electricity, gas and heat . . . **Kissimmee, Fla., City Commission** has rejected Florida Power Corp's proposal to sell the city electric power. City is operating its light plant at almost peak capacity. Commission probably will buy one or two diesel generators to take care of any future increased load . . . **Public Service Co of Northern Illinois,** a subsidiary of Commonwealth Edison Co, may be merged into and become a division of the parent company, Charles Y. Freeman, chairman of both companies, has announced.

WASHINGTON COMMENT

JESSE MOCK

While Washington observers expect no major changes in federal power policy under the incoming Republican administration, they are on the lookout for small shifts away from the present paternalistic attitude.

Public power enthusiasts already have their keen eyes trained on one specific situation which they believe will be a key to what they may expect during the next four years under the Republicans. If this one should be settled before Jan. 20, they will have to cast around for another straw in the wind.

A New Type of Contract Puzzles Interior

This specific case involves the outcome of the Georgia Power Company-Interior Department power marketing contract which lies unsigned on the desk of Interior Secretary Oscar L. Chapman. It has been there since Sept. 11.

In its present form the contract would deviate from Interior's present policy of either building transmission lines to carry government-produced power to preference customers or entering "wheeling" contracts with electric companies to accomplish the purpose.

A New Type of Contract . . . Instead, the present contract would permit Georgia Power to purchase power generated at the govrenment-owned Clark Hill Dam and deliver specified quantities of power off its own system to customers designated by Interior. These preference customers would pay less than normal wheeling charges for their share of the power from the Clark Hill project delivered by the company. In this way, the preference customer would remain a customer of the company.

Interior's present policy differs considerably from the terms of the contract. The reasoning is this: Congress stated in the Flood Control Act under which Clark Hill was authorized that preference in sale of power from the project should be given to public bodies and cooperatives. Congress intended that these preferred agencies would have the opportunity to buy direct from the government.

In line with this policy, Interior has either built transmission lines or entered "wheeling" agreements to bring the government power to preference customers. These customers then become direct customers of the government.

Terms of the Contract Are Attractive . . . The terms offered by Georgia Power have presented a tough problem for the Interior top command. In effect, the company offers the government and the preference customer every financial and service benefit available under existing "wheeling" contracts. Major difference is that the company retains its customers rather than sharing them with the government.

In fact, the terms of the present contract are so attractive that one top official at Interior strongly urged its acceptance. And even some preference customers admit the contract has appeal.

Congress, too, has indicated it will meet the demands of the preference clause. Earlier this year the lawmakers refused to grant Interior enough money to build government transmission lines in Georgia. Instead it urged that Interior again attempt to negotiate contracts with electric companies. A spokesman for the Senate Appropriations Committee said terms of the contract appeared acceptable.

But public power advocates are wary of the contract. They see it as a threat to the preference clause—especially as that clause has been interpreted by the Interior Department during the past ten or fifteen years. But on the other hand it does avoid outright bus-bar sales.

It will take only a very slight change in attitude to clear the contract. Pressure for some kind of agreement is mounting as the Clark Hill project begins turning out power. First 40,000-kw unit went on the line last week.

If Chapman holds out, then the decision will be up to the next administration.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Polyethylene has a 60-cycle dielectric strength of 1338 volts per mil, at 600 cycles 940, and at 9.81 megacycles only 224. Anti-oxidant addition of 1% decreases the dc dielectric strength from 17,300 to 14,600 volts per mil.

Coals with ash content ranging from 4 to 25% and Btu values from 7,000 to 13,500 have been handled successfully by the same spreader stokers under the same load conditions without appreciable striction on steaming capacity.

Intercommunication and paging system may well be the last function permitted to be lost in a plant disturbance.

Inspection to detect flaws in auxiliary equipment entails insignificant cost if it averts loss of the output of the associated generator.

Venting of turbine oil systems helps get rid of moisture and prevent corrosion above the oil level.

Voltage regulators cost 3 to 4 times as much per kva in the sizes commonly used on feeders as for the larger sizes appropriate for bus regulation.

Demand is fully intelligible and entirely unambiguous to the engineer planning to meet system requirements. It is often unintelligible and obnoxious to a customer assessed in proportion to his requirements.

Turbine oil "sweetening" has given way to use of inhibited oil. The old idea was to withdraw and discard a fraction of the used oil periodically and replace it with new. The used oil was supposed to last longer under the influence of the new.

Metropolitan systems may sacrifice more in station economy than they save in transmission losses if loadings are manipulated with the latter primarily in view.

Sound barrier for a noisy transformer should be built close to the transformer but not so close as to interfere with ventilation.

Polyethylene has quite constant dc dielectric strength up to 30C but then decreases sharply until at and above its 100C melting point it is only 2400 volts per mil.

Gas Turbine Power Plants . . . More and Bigger

ASME Progress Report of American and European Machines shows many more under construction. Larger European Machines show trend toward higher efficiency than American, but operate at lower gas temperatures

Abstracted from Centennial of Engineering paper by Lee Schneitter, Ebasco Services, Inc.

Company and Location	Kw Rating	Builder	Initial Operation	Fuel	Operating Cycle	Press. Ratio	Thermal Eff. %	Inlet Gas Temp. F.	Shafts	Intercoolers	Regenerators	Combustors	Compressors
United States of America													
P. S. Co. of Okla., McAlester, Okla	15,000	Westinghouse	1954	Nat. gas	Comp.	—	25.7	1350	2	1	1	Mult.	2
Bangor Hydro-Elec. Co., Bangor, Me.	5,000	Gen. Elec.	1950	Oil	Comp.	9.0	26.4	1500	2	1	1	Mult.	2
	5,000	Gen. Elec.	1952	Oil	Comp.	9.0	26.4	1500	2	1	1	Mult.	2
Cen. Vermont P. S. Co., Rutland, Vt.	5,000	Gen. Elec.	1951-2	Oil	Comp.	9.0	26.4	1500	2	1	1	Mult.	2
	5,000	Gen. Elec.	1951-2	Oil	Comp.	9.0	26.4	1500	2	1	1	Mult.	2
	5,000	Gen. Elec.	1951-2	Oil	Comp.	9.0	26.4	1500	2	1	1	Mult.	2
P. S. Co. of Okla., Elk City, Okla	5,000	Gen. Elec.	1951	Nat. gas	Comp.	9.0	25.5	1500	2	1	1	Mult.	2
West Tex. Utilities, Stockton, Tex	5,000	Westinghouse	1952	Nat. gas	Simple	—	18.3	1350	1	0	0	Mult.	1
Conn. L. & P. Co	5,000	Gen. Elec.	1952-3	Oil	Comp.	9.0	26.4	1500	2	1	1	Mult.	2
	5,000	Gen. Elec.	1952-3	Oil	Comp.	9.0	26.4	1500	2	1	1	Mult.	2
	5,000	Gen. Elec.	1952-3	Oil	Comp.	9.0	26.4	1500	2	1	1	Mult.	2
	5,000	Gen. Elec.	1952-3	Oil	Comp.	9.0	26.4	1500	2	1	1	Mult.	2
Narragansett Elec. Co	5,000	Gen. Elec.	1953	Oil	Comp.	9.0	26.4	1500	2	1	1	Mult.	2
Texas P. & L. Co., Gainesville, Tex	4,000	Gen. Elec.	1952	Nat. gas	Regenerative	5.5	21.5	1450	2	0	1	Mult.	1
Okla. G. & E. Co., Belle Isle, Okla	3,500	Gen. Elec.	1949	Nat. gas	Simple	6.0	15.6	1400	1	0	0	Mult.	1
	3,500	Gen. Elec.	1952	Nat. gas	Simple	5.0	15.6	1400	1	0	0	Mult.	1
Cent. Maine Power Co., Augusta, Me.	3,500	Gen. Elec.	1950	Oil	Simple	6.0	16.2	1400	1	0	0	Mult.	1
Montana-Dakota Pwr. Co., Williston, N. Dakota	3,500	Gen. Elec.	1953	Nat. gas	Simple	6.0	15.6	1400	1	0	0	Mult.	1
	3,500	Gen. Elec.	1953	Nat. gas	Simple	6.0	15.6	1400	1	0	0	Mult.	1
Switzerland													
N. E. Power Co., Beznau	27,000	Brown-Boveri	1949	Oil	Dbl. Comp.	8.0	32.4	1112	2	1	1	—	4
N. E. Power Co., Weinfelden	20,000	Sulzer Bros.	1950	Oil	Semi-closed	20.0	30.1	1200	3	2	1	—	2
N. E. Power Co., Beznau	13,000	Brown-Boveri	1948	Oil	Dbl. Comp.	8.0	28.7	1112	—	—	—	—	—
Mun. Elec. Supply, Neuchatel	4,000	Brown-Boveri	1939	D-oil	Simple	4.0	16.9	1020	—	—	—	—	—
Great Britain													
Unspecified	20,000	English Elec.	—	Oil	—	—	—	—	—	—	—	—	—
	20,000	English Elec.	—	Oil	—	—	—	—	—	—	—	—	—
Brit. Elec. Auth., Trafford	15,000	Met.-Vickers	1952	D-oil	Comp.	10.0	26.3	1200	—	—	—	—	—
Brit. Elec. Auth., Dunston "A"	15,000	Parsons	U.C.	Oil	Comp.	8.0	26.3	1200	2	2	4	Mult.	2
No. Scotland Hydro-Elec. Board, Dundee	12,500	John Brown	U.C.	Oil	Closed-Comp.	10.0	30.9	1250	—	—	—	—	—
Nat'l. Gas Turb. Est., Pyestock	10,000	Parsons	U.C.	Oil	Comp.	10.0	26.4	1200	2	2	4	Mult.	2
Met. Water Board	2,500	Brush Elec.	U.C.	D-oil	Simple	4.0	15.6	1340	—	—	—	—	—
Met. Water Board	2,500	Met.-Vickers	U.C.	D-oil	Simple	5.4	16.0	1290	—	—	—	—	—
Other													
Elect. de France, St. Denis, Paris	12,500	Escher-Wyss	U.C.	Oil	Closed	11.6	32.0	1250	2	3	1	—	5
Filaret Sta., Bucharest, Romania	10,000	Brown-Boveri	1951	Nat. gas	Comp.	12.0	21.4	1100	—	—	—	—	—
Lima L. P. & Tramwy Co., Santa Rosa Sta., Peru	10,000	Brown-Boveri	1949	Oil	Comp.	8.0	28.2	1100	—	—	—	—	—
Arbed Steel Works, Dudelange, Luxemburg	5,400	Brown-Boveri	—	Gas	Regenerative	3.6	21.4	1112	—	—	—	—	—
C. A. Venezulana de Cem, Caracas, Venezuela	5,000	Brown-Boveri	1952	Nat. gas or Oil	Simple	4.6	18.0	1112	—	—	—	—	—
Arab.-Amer. Oil Co	5,000	Brown-Boveri	U.C.	Nat. gas	Simple	4.6	17.0	1200	—	—	—	—	—
	5,000	Brown-Boveri	U.C.	Nat. gas	Simple	4.6	17.0	1200	—	—	—	—	—
	5,000	Brown-Boveri	U.C.	Nat. gas	Simple	4.6	17.0	1200	—	—	—	—	—
	5,000	Brown-Boveri	U.C.	Nat. gas	Simple	4.6	17.0	1200	—	—	—	—	—
Corp. Peruano del Santo, Chimbote, Peru	4,000	Brown-Boveri	1949	Oil	Simple	4.6	18.3	1100	—	—	—	—	—
Anglo-Iranian Oil Co	4,000	Brown-Boveri	U.C.	Nat. gas	Simple	4.6	16.4	1100	—	—	—	—	—
	4,000	Brown-Boveri	U.C.	Nat. gas	Simple	4.6	16.4	1100	—	—	—	—	—
	4,000	Brown-Boveri	U.C.	Nat. gas	Simple	4.6	16.4	1100	—	—	—	—	—
East African P & L Co	2,500	BTH	U.C.	Oil	Simple	4.6	20.	1200	—	—	—	—	—
	2,500	BTH	U.C.	Oil	Simple	4.6	20.	1200	—	—	—	—	—

This tabulation omits some smaller units, also those obviously not for central station power generation.

Some Virtues of the Gas Turbine For Power Generation

1. Simple installation, requiring minimum excavation, smaller buildings, and lighter crane equipment.
2. Small physical size of station compared to an equivalent steam plant because of the elimination of large boilers, condensers, auxiliaries, and external piping not needed in gas turbine operation.
3. No basement or high superstructure required. Turbines are single level units with the exception of the regenerative cycle design which requires a ventilated trench or elevated operating deck for interconnecting ducting between gas turbine and regenerator.
4. Less cooling water is required.
5. Short time starting ability renders the gas turbine particularly applicable for peak load, standby, or emergency service.
6. When not operating, the gas turbine has no standby losses.
7. Gas turbine starting and supervisory control is very nearly automatic and can readily be converted to automatic operation when used on natural gas or light distillate oils. At this stage of the development, it would not be recommended that remote automatic control be installed on a residual oil-fired unit.

Is the Gas Turbine Tomorrow's Prime Mover?

Simple in design and operation, free from the need of large water supplies, gas turbine types now in use for base load and standby service, may well become the prime mover of the future

B. G. HATCH, Gas Turbine Dept. Turbine Div, General Electric Co, Schenectady, N. Y.

Today's gas turbine has many advantages for power generation. Developments have been very rapid in the past few years. Operating and maintenance experience has been encouraging. This new power plant is just assuming full stature as a prime mover and offers attractive possibilities for future power developments.

Together with the reduction in requirement for cooling water, virtues of the gas turbine, listed above, favor its use at remote load centers to provide better service from the standpoint of voltage regulation and stability and to protect against loss of service. When installed as end-of-line plants, gas turbine units will stabilize outlying load and improve local service as well as reduce system losses.

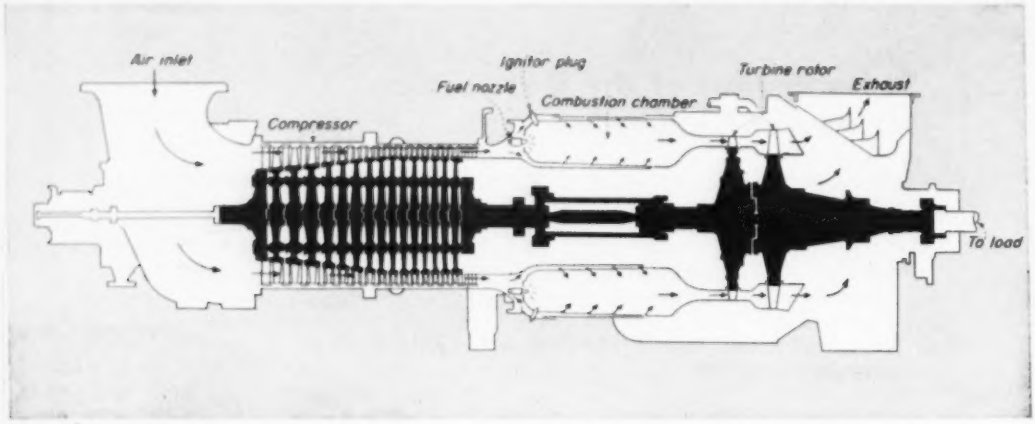
Another advantage is that few outside operating accessories are required after the plant is in operation. Thus, a plant can be installed in a fast growing load center and removed to a new load center when conditions warrant.

Several factors have conspired to stimulate the pace of gas turbine development. Principal among these was the wartime work on jet engines for high-speed, high-altitude aircraft and the parallel strides made in airfoil design and metallurgy. This when linked with the experience of 50 years of steam turbine design and research has resulted in the present promise of today's gas turbines as the prime mover for tomorrow's power plant.

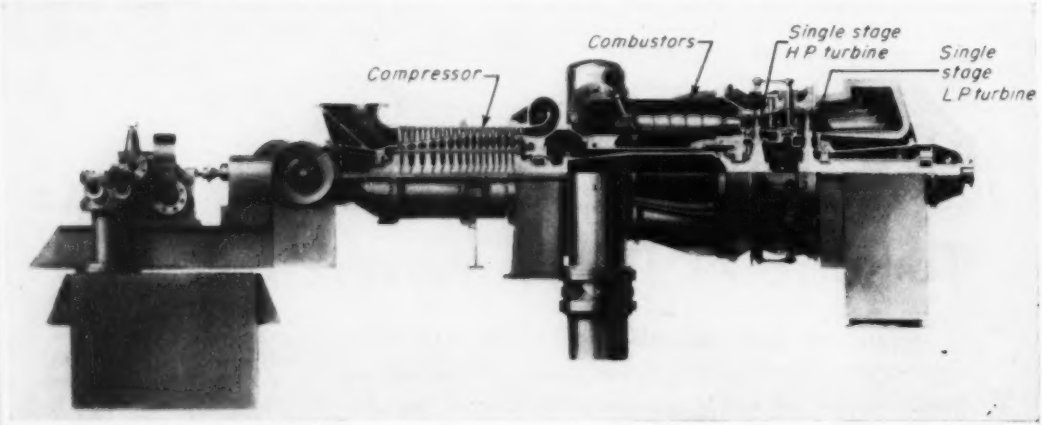
Today, simple-cycle gas turbine power units of 3,500-kw rating are in base load and standby service on systems of Oklahoma Gas & Electric Co and Central Maine Power Co. Compound-cycle units that utilize regenerators and inter-coolers to improve efficiency have gone into regular base load and daily peaking service at generating stations in Maine, Oklahoma, and Vermont.

Still a third type, a regenerative cycle unit rated 3,500 kw, was placed in operation by the Texas Power & Light Co in April 1952. In addition a large number of duplicate 5,000-hp units without electric generators are being installed and are on order to drive centrifugal compressors on long distance natural gas pipelines. A gas turbine of the 15,000-kw class has been considered for development and for use in larger central stations where high efficiency during base load operation can be fully utilized.

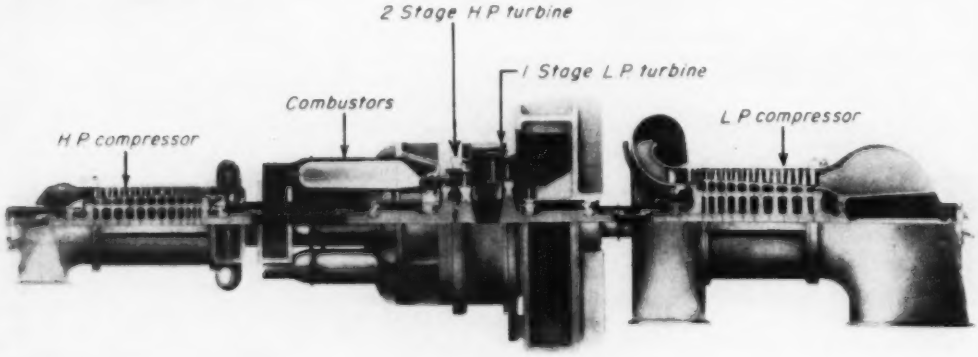
For details of modern gas turbine power plants please turn page



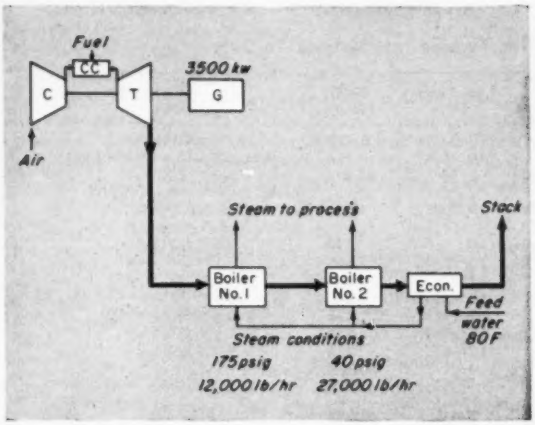
SIMPLE CYCLE comprises an air compressor, combustion system and gas turbine with necessary accessories. Compressor boosts air pressure before it is fired with fuel to 1400F in combustors and expands through turbine



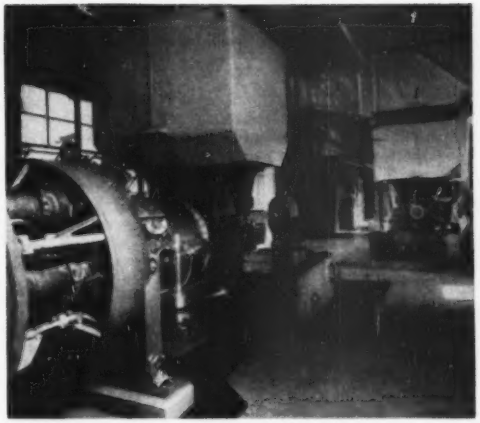
REGENERATIVE CYCLE provides for preheating compressed air before it enters combustors. Separate H.P. turbine drives compressor, auxiliaries while L.P. turbine drives generator. Exhaust passes to regenerator



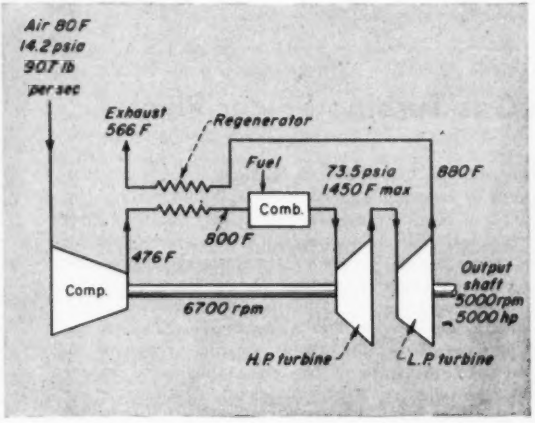
COMPOUND CYCLE divides compressor into low-and-high-pressure stages with intercoolers between. Compressed air passes through regenerators and is heated by LP turbine exhaust as in the regenerative cycle



Heat in exhaust gases is commonly used to heat feed water of associated boiler steam turbine combination, improving efficiency

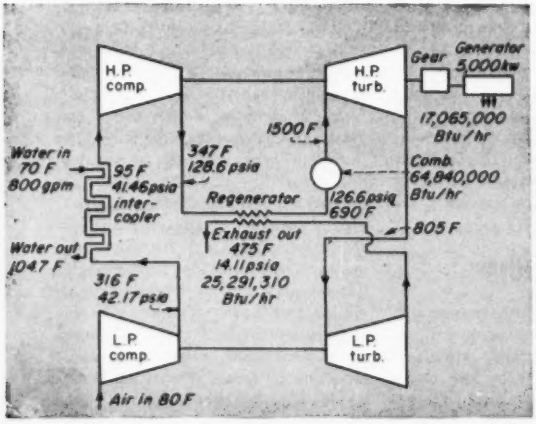


This was done at Belle Isle station of Oklahoma G&E in both the original 3,500 kw unit, rear, and new 4,000-kw unit, foreground

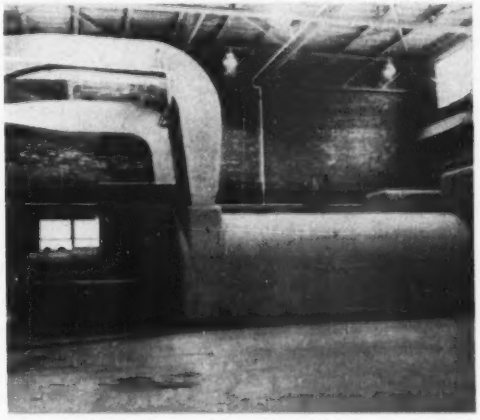


Cycle efficiency is improved by this use of turbine's exhaust heat within its own cycle. Regenerator raises cycle efficiency to 24 or 25%.

Initial regenerator installation is a 5,000 kw unit, above, at the Gainesville station of the Texas P&L, and end-of-line plant



High pressure turbine drives the HP compressor directly, generator through reduction gear; gives better full-, good part-load efficiencies



Bangor Hydro Electric unit, above, installed in 1950, is used for base load and system peak operation and is located at Veazie, Maine.

History of Existing General Electric Gas Turbine Installations To-Date

Plant	Rating	First Operation	Last Report Date	Total Hours	Output
Demonstrator Locomotive	(4500 hp)	11/16/48	10/20/51*	6,433	113,677 Miles
Union Pac. Locomotives No. 1, 2, 3, 4, 5 & 6		1952	10/ 1/52	12,164	About 10,000 Miles/Month/Loco.
Okla. Gas & Electric No. 1	(3500 kw)	7/29/49	9/30/52	24,714	109,523,000 kwhr (All Time Average 4480 kw)
Okla. Gas & Electric No. 2	(4000 kw)	7/21/52	9/30/52	1,315	6,245,000 kwhr (All Time Average 4810 kw)
Central Maine	(3500 kw)	8/30/50	10/ 6/51**	726	2,040,000 kwhr
Bangor Hydro Electric No. 1	(5000 kw)	10/28/50	10/21/52	1,552	3,571,380 kwhr
Bangor Hydro Electric No. 2	(5000 kw)	3/ 7/52	7/27/52	246	238,200 kwhr
Pub. Service Co. Okla. No. 1	(5000 kw)	6/16/51	10/16/52	7,640	23,771,200 kwhr
Cent. Vt. Pub. Serv. No. 1	(5000 kw)	8/27/51	8/19/52	1,478	3,857,500 kwhr
Cent. Vt. Pub. Serv. No. 2	(5000 kw)	6/ 4/52	10/16/52	918	2,396,000 kwhr
Texas Pr. & Light Co.	(5000 kw)	4/25/52	10/16/52	854	2,417,600 kwhr
El Paso Natural Gas Co	(5000 hp)	9/10/52	9/29/52**	Started Commercial Pumping of Natural Gas on 24 Hour Basis	
			Total	58,040	

* Demonstration Terminated.
** No Recent Reports. Operating About 40 Hours Per Week
Note:
Since preparation of above table, several of the 5000 HP gas pipeline units have been placed in regular commercial service.

TOMORROW'S PRIME MOVER (continued from page 101)

Three Basic Cycles Are Used In Gas Turbine Power Plants

1. Simple Cycle Gas Turbine

The first practical simple-cycle gas turbine in this country was conceived as a small, lightweight power plant adaptable to a single-cab railway locomotive. For this, the simple open-cycle was adopted and has become known as the locomotive type gas turbine even though it has been used in two 3,500-kw central generating units.

This simple-cycle gas turbine consists essentially of an air compressor gas turbine, combustion system, and necessary controls and accessories. Air at normal pressure is compressed to six atmospheres and introduced into six all-metallic combustion chambers. Fuel is fired to heat the compressed air to 1,400 F. It is then expanded through the two stage turbine that drives the air compressor and the 3,500 kw generator.

Besides its compressor, the turbine drives such accessories as a governor and fuel regulator system; multi-piston, metering-type fuel oil pump (or corresponding gas fuel valve when operated on natural gas); an overspeed governor; tachometer; positive displacement lubricating oil pump; and an atomizing air compressor used if petroleum is the fuel.

Output power developed by the turbine, less than is required by the compressor, drives a 3,600 rpm 60-cycle generator through reduction gears. As no heat recovery devices are included in the simple cycle, this unit can be most economically used in areas of low priced fuel, either for peak load or standby purposes. However, since a large quantity of exhaust gas is available at approximately 800 F, secondary heat is recoverable to greatly improve the overall cycle efficiency. At the Belle Isle Station of the Oklahoma Gas & Electric Co this exhaust is used to preheat boiler feed water for the adjacent steam power plant. Operating as a base load unit, with over three years operation and no repairs, this unit with its secondary heat recovery has been so successful that a duplicate unit has just been installed by this company and helped carry the summer load of 1952.

2. Regenerative Cycle

Efficiency of the gas turbine can be improved by using waste exhaust heat within its own cycle. After having been compressed by the shaft-driven air compressor, air in the regenerative cycle is passed through a gas-to-air heat transfer regenerator before it is admitted to the combustion chambers. Within the combustion chambers, firing of fuel further heats the air to the required turbine operating temperatures. Again after expanding the gas through the turbine, it is passed through the regenerators where the heat contained in the exhaust is partially recovered before the gas is discharged to the stack. Addition of the regenerator raises the cycle efficiency from approximately 16 to 17% for the simple cycle and to 24 or 25% for the regenerative cycle.

Since the regenerative cycle is intended for greater flexibility and higher economies, a second independent load shaft is used. Hot gases from the combustion system first expand through the high pressure turbine that drives the air compressor only. After passing through the high pressure turbine, the discharged gases expand further through the independent load-turbine which is mounted in the same casing as the high-pressure turbine, as a tandem compound unit. As the load turbine is not restricted in its operation by the characteristics of the compressor, it can be regulated for variable speed at variable loads making it particularly suitable to drive centrifugal compressors. Because the air compressor speed can vary inde-

pendently with load, this unit results in higher part load efficiency.

The load turbine can also be regulated for variable load and constant speed. Therefore, it may be connected through reduction gears to a 3,600 rpm, 60-cycle generator for power generation. The first unit of this design has been installed at the Gainesville Station of Texas Power & Light Co. as an end-of-line power plant, and helped carry the summer 1952 load.

3. Compound Cycle

By dividing the compressor into a low and a high pressure section, with intercoolers between, efficiency can be raised. After compression by the low pressure compressor, the air is cooled to approximately its initial temperature before entering the high pressure compressor. This reduces the power equipment and size of the high pressure compressor and increases the efficiency of the gas turbine. After the second stage of compression, the air is passed through regenerators and heated by the turbine exhaust, as in the regenerative cycle, before it is admitted to the combustion chambers. Again fuel raises the temperature in the combustion system to the requirements of the turbine, and the hot gases are expanded through a high pressure and a low pressure turbine mounted in the same casing, before being exhausted to the stack through the regenerator.

In this cycle, the high pressure turbine operates at constant speed to drive the high pressure compressor, and through reduction gears to drive the electric generator.

From the high pressure turbine, partially expanded gases are further expanded in a low pressure turbine which drives the low pressure compressor only, at speed variable with load. In addition to better full load efficiency, this cycle permits good part load efficiency.

Five units of this type have been installed by the Bangor Hydro Electric Co, Public Service Co of Oklahoma, and Central Vermont Public Service Corp. These units are used for base load and peak operation. One acts as an end-of-line power plant to firm up load in a remote part of the system.

Appeal of the gas turbine power plant lies in its simplicity and its ability to convert energy directly from fuel into useable mechanical or electrical form. In the simple- and regenerative-cycle units, no water is used although small quantities are required for cooling lubricating oil, generator, and turbine frame. This cooling may be done in a closed system, minimizing losses from evaporation and required makeup, by the addition of a water-to-air radiator.

The compound cycle unit requires circulating water in the cycle for the intercoolers, but the total water is much less than in other conventional power plants.

To obtain desired efficiencies, temperatures of 1,400 to 1,500 F are required at the first stage turbine nozzles. These high temperatures require special high temperature materials such as austenitic metals for inner liners to the combustion chambers, the first stage nozzle assembly, the first stage turbine buckets and wheel rims only, succeeding nozzle partitions, turbine buckets, and wheel rims. Supplemental cooling of the turbine wheels and wheel spaces is accomplished by air from the compressor or by radiation.

Operating Results

First commercial simple cycle generating station power plant, rated at 3,500-kw, and designed for operation on natural gas was factory tested on oil. Individual combustion chambers and fuel nozzles were developed and tested on propane gas, diluted as necessary with nitrogen. The unit had never been fired on natural gas until after its installation. After about 19,000 hr. it was opened for its third semi-annual inspection and found to be in perfect operating condition. It has now accumulated over 24,000 hr of firing operation and generated over 107 million kw hr. During its entire operation, the unit has averaged better than 20% in excess of its rating, at thermal efficiencies better than guaranteed. Exhaust heat from the gas turbine is recovered through an outdoor-mounted recuperator to heat boiler feed water for the adjacent steam station. This results in an additional gain of some 3,000-kw capacity in the steam station with an overall increase in efficiency.

The second simple cycle generating unit was installed at the Farmingdale Station of Central Maine Power Co. Despite the inherent fuel rate of about 23,000 Btu per kwhr, the economy of this gas turbine in comparison with the older, small low pressure steam turbines was such as not to warrant the addition of secondary heat recovery. This unit is planned for system peaking and standby and is capable of being placed on the line in a very few minutes when needed.

The first compound cycle design, a 5000-kw unit including regenerators and intercoolers, was installed at the Edward M. Graham Station of Bangor Hydro Electric Co. It is used for daily system peaks as well as base load operation during shortage of hydro-electric generation. A second duplicate unit has just been installed in this station.

The second unit of this design is installed in the Elk City Plant of the Public Service Co of Oklahoma and is operated as a base load and end-of-line plant. The Elk City plant, as well as the two at Oklahoma Gas & Electric, and the regeneration cycle plant of the Texas Power & Light Co operate on natural gas fuel.

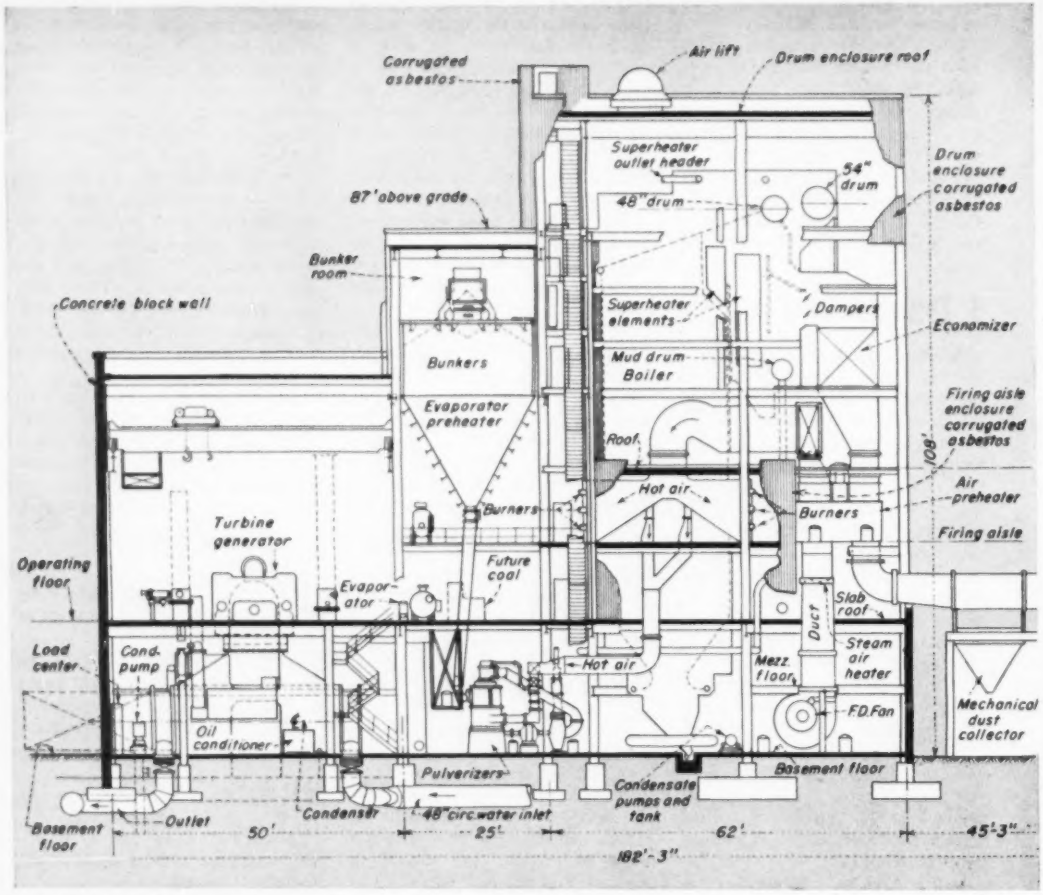
Two duplicate 5,000-kw units have been installed in the Rutland Plant of the Central Vermont Public Service Corp. These units likewise are planned for daily system load peaks as well as for base load operation. All five New England units burn oil.

Heat Rates

The simple cycle has a single, straight through pass of air from atmosphere through the compressor and combustion system to the turbine with discharge at high temperature to atmosphere. With no heat recovery devices in the system, the heat rate is about 23,000 Btu per kwhr. The heat rate chargeable to power generation can be materially improved after exhaust heat is recovered in the form of steam for process use.

In the regenerative cycle design, exhaust heat is partially recovered in the power plant cycle and is used to heat the air after compression but before combustion, thus reducing fuel requirements. The heat rate is improved to 15,000 or 16,000 Btu per kwhr.

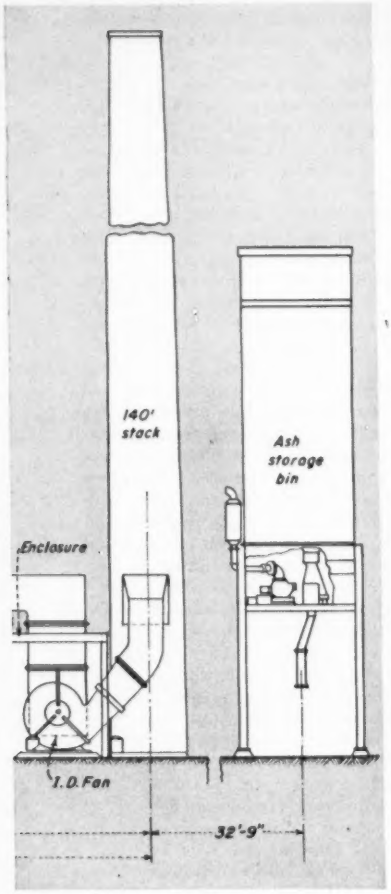
The compound cycle power plant goes one step further by dividing the compression cycle into two stages with intercooling between. This, in addition to the regenerator, results in an expected heat rate of about 13,000 Btu per kwhr.



UNIT DESIGN was followed with two 425,000 lb per hr boilers and two 44,000 kw turbine generators. Controls are located in a centralized control room. Boilers are of the three-drum, bent-tube, water-cooled furnace type. Turbine room bay will be 244 ft long, 50 ft wide and 65 ft high. Building is of structural steel with concrete block walls. Boiler exposed except for drums and firing aisle

BOILERS, located between building structure and stack, will be outdoor with exception of firing aisle. Unit design provides for two units and two boilers. Turbine generators are preferred standard 40,000 kw units. Offices and service areas will be housed at right.

INCHING ARRANGEMENT will keep all coal conveyor belts in motion when not handling coal to avoid freezing of belt to rollers during extreme cold weather. Outdoor portion of conveyor belts will be housed-in with steel plates



Semi-Outdoor Plant Invades Cold Minnesota

Station in iron range country makes these concessions to weather: Enclosures around firing aisle, ID fans, and circulating pumps; inching scheme to keep conveyors from freezing

F. S. RICE, Chief Engineer
HUBBELL CARPENTER, Asst. Chief Engineer, Minnesota Power & Light Co, Duluth

Outdoor and semi-outdoor plants are not unusual in Texas and some other southern climes. Further north, however, they have been the exception rather than the rule. But today more and more northern companies are venturing experimentally in this direction in search of the same savings in building costs that have been realized in the south.

Minnesota Power & Light Company's new Aurora Station now under construction on a natural peninsula on Colby Lake 65 mi north of Duluth is a recent example of semi-outdoor construction in sub-zero country. All of Aurora Station's equipment is housed except the boilers. They are enclosed on the firing aisle, around the drums, induced draft fans and circulating water pumps.

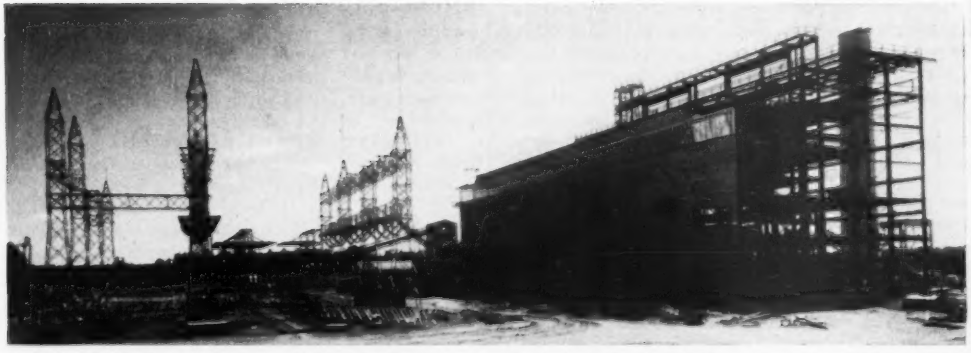
The station site, on the eastern end of the Mesabi iron range, is near the company's rapidly growing iron mining load (EW Nov. 24, p 32-33) and also near an adequate condensing water supply. Initial construction includes two 44,000-kw preferred standard units. Substantial capacity can be added when and as needed.

The plant is designed basically for pulverized coal, to be shipped by rail from upper lake ports. Provision is also being made for burning either oil or gas.

Thermodynamics . . . Plant heat balance will be designed for five stages of extraction heating and condenser deaeration. All heaters will be of the closed type with the third stage extraction also supplying steam to the evaporators. Drains in general will be cascaded to the next lower heater. Drip pumps will be used where required.

A bent tube type evaporator with open deaerating preheater and evaporator feed pump is to be used for supplying makeup to each of the two boilers. Raw water fed to the evaporators is to be taken directly from the lake without treatment. Sanitary water is supplied from a deep well but cannot be used for makeup because of hardness. Service water in plant, except drinking, is supplied directly from the lake.

Four multi-stage centrifugal boiler feed pumps are being installed—two for each unit. All pumps are electric-



TWO SWITCHYARDS, one 110 kv and one 44 kv, will be of the high box girder type and will be located adjacent to the station. Building proper includes turbine room bay 244 ft long, 50 ft wide and 65 ft high and is of structural steel with concrete block walls. Top portion of bunker bay wall and enclosed portion of boilers will be corrugated asbestos. Roof over turbine room, plant office and service area will be of pre-cast concrete slabs designed to withstand the weight of 21½ ft of snow

Equipment Data—Aurora Station

Boilers, number	2
Boiler rating, lb/hr	425,000
Throttle pressure, temp	1,250 psi, 950F
Turbo-generators, units	2
Turbo-generators, rating	40,000/44,000 Kw ASME-AIEE
Generator, nominal rating	47,058 kva 85% pf at 0.5 psig hydrogen 58,822 kva 85% pf at 30 psig hydrogen
Condensers (2), rating	25,000 sq ft surface 280,000,000 Btu/hr
Circulating water pumps (2), rating	@ 25 ft total head 46,500 gpm
Transformers 2/unit	25,000 kva
Circuit breaker, oil....1/unit	110-kva
Auxiliary transformers	3,750 kva 13,800/2,400 v

ally driven and have automatic bypass controls for low loads. Pumps are designed for 475,000 lb per hr capacity at a 3,700 ft total dynamic head. Two condensate storage tanks, each of a capacity of 250,000 lb, will take excess condensate from the condensate pumps and will supply condensate to the deaerating section of the condenser.

An automatic three-element boiler feed regulator, one for each unit, will be installed with a motor-driven bypass and shut off valves.

Miniature control boards, as developed by Ebasco Services Inc in conjunction with manufacturers, will combine all the usual gages and controls normally found on the turbine and boiler gage boards and will be located in a centralized control room. A boiler firing aisle cubicle will be installed at each boiler for the purpose of transmitting boiler conditions to the control room and also making certain that this information is available at the boiler.

A complete automatic combustion control system will be used with centralized controls located on the miniature control board in the centralized control room.

Coal and Ash Handling . . . The coal storage area east of the plant, on the tip of the peninsula, is large enough to store over 200,000 tons. Equipment to be used for coal handling consists of a 45-ton diesel electric locomotive, a bull dozer with a 27½-cu yd carryall and a five-ton car shaker. The track hopper is of sufficient size to handle a standard 70-ton gondola or two ore cars.

From the hopper a double-feeder supplies an inclined belt conveyor which delivers fuel to a crusher house. Here are located an automatic sampler, crusher, and equipment to transfer coal either to the bunkers or storage. A weightometer is installed on the belt from track hopper to crusher house. Initial capacity of the coal handling equipment is 170 tons per hour, with ultimate capacity of 420 tons per hour.

To keep belts from freezing to rollers in extreme weather, all belts are kept in motion by an inching arrangement when not handling coal.

A pneumatic system will remove and store ash. A glazed-tile, ash-storage bin, 18 ft in diameter by 40 ft 6 in high, will have a capacity of 200 tons. All vacuum inducing and dust separating equipment is mounted on top of the ash storage bin. A dustless unloader is located under the silo.

Cooling Water . . . The intake structure, located on the south side of the peninsula, is composed of two bays each containing a trash rack, two fine screens, and a circulating water pump. The circulating water pumps will be exposed to the weather. Provisions are made for a traveling screen and chlorination, but at present installation is not contemplated.

A sealed concrete discharge structure is located on the north side of the peninsula, thus interposing a considerable distance between it and the intake. Each circulating water pump discharges into a pressure system for each individual unit. Piping is of reinforced concrete lock joint design. A pressure recirculating system, to minimize condensate refrigeration and freezing in front of intake, is handled by restricting flow at the discharge structure.

Turbine-generating Unit . . . Each turbine-generator is an ASME-AIEE preferred standard 40,000-kw unit rated at 44,000 kw maximum turbine capability when operating at 1,250 psi and 950 F. Each generator has a direct-driven exciter and pilot exciter. A start-up panel is to be located at the turbine end with gages to indicate pertinent turbine conditions. Major instruments will be installed on a miniature control board in the centralized control room.

The two 25,000-kva main transformers for each generator are located near the north side of the building and have a 110-kv oil circuit breaker on their "high" side. Main generator leads are factory-built, isolated-phase type extending just outside the building wall in dust-tight enclosures and continuing to the point of attachment to the transformer tie busses in open bus construction. General potential transformers will be mounted in the building. A neutral reactor will also be installed.

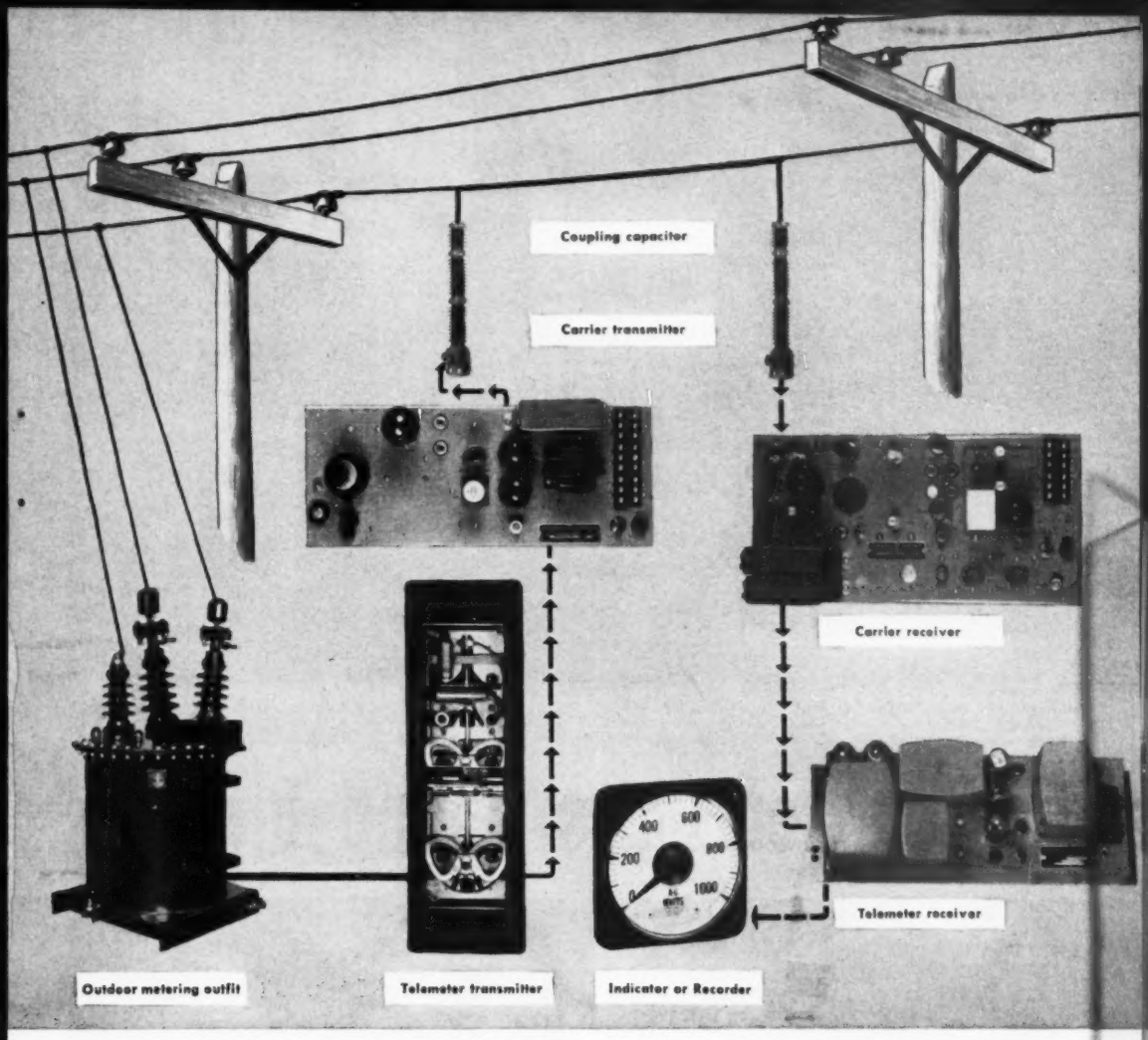
Generator controls will be combined with the boiler turbine controls located in the centralized control room. High tension lines, two 110 kv and two 44 kv, will be controlled from the centralized control room. The transmission control panel is a standard tunnel type.

Power for auxiliaries is to be supplied through unit 3,750-kva three phase 13.8/2.4-kv transformers connected directly to generator leads. Two 2,000-kva three-phase transformers supply 2,400-v standby from the 44-kv switch yard.

The station auxiliary electrical system will follow the unit basis of the main plant equipment. This will consist of a group of metalclad switchgear, rated 5,000-v, 110,000-kva interrupting capacity for each unit. Interrupting capacity is based on the two main units not being operated in parallel through the standby auxiliary source for any length of time.

The lower voltage station service of 480 v is for motors up to and including 250 hp. This equipment will be of the unit substation type.

Switchyard . . . Two switchyards are provided, one for 110-kv and one for 44-kv transmission. The 44-kv switchyard is supplied from the 110-kv yard through two 7,500-kva, three-phase transformers operating in parallel.



G-E "Packaged" Carrier-current Telemetering

Simple Design Provides High-speed Trouble-free Telemetering Service

Continuous frequency-type telemetering by General Electric is a compact, flexible, economical system that is service proven by many installations. The completely packaged system is simple in design and provides a fast and continuous output signal.

Costing no more initially than the slower impulse-type systems, G-E continuous frequency-type telemetering requires practically no maintenance. There are no contacts or commutators . . . just one moving part. Calibration is simple, using well-known watthour-meter techniques.

RAPID RESPONSE—Because G-E frequency-type telemetering is so rapid in response, it will give an accurate indication or record of even rapidly fluctuating voltages or loads. The compactness of the equipment is demonstrated by the fact that three telemeter transmitters can be put in approximately the same panel space as one wide-chart recorder.

CO-ORDINATED SYSTEM—Since the telemeter instrument components have been fully co-ordinated with the carrier channel components, the total number of tubes required by the system is kept to a minimum.

Frequency-type telemeter equipment can be used for telemetering watts, amperes, voltage vars, position, and other electrical quantities. It can be used with most other types of totalizing and telemetering equipment.

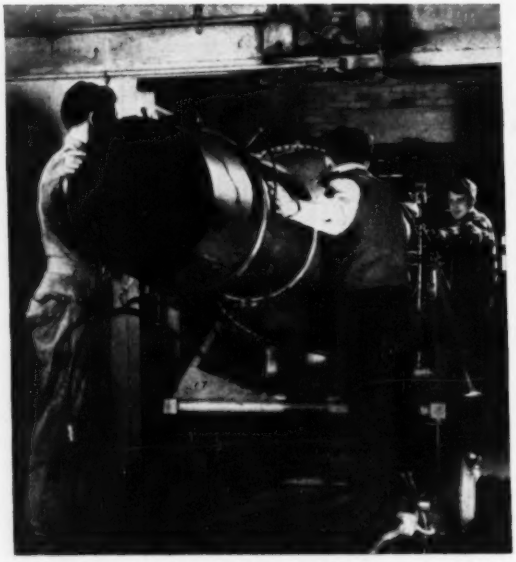
For more information about G-E carrier-current telemetering, contact your nearest G-E apparatus sales office or write for Bulletin GEA-5233 to: Section 605-28, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

TRANSFORMERS FOR POWER TO MANUFACTURE JETS. While power house is built, locations are marked for the two 750-kva transformers shown in background. The double-ended load center, ready for installation here, will serve auxiliary loads for Packard's new jet engine plant in Utica, Mich. Plant also contains six G-E load-center unit substations installed in three groups.

Load-center units speed building

G-E HIGH-VOLTAGE LIGHTING gives Packard adequate lighting with maximum flexibility and savings in copper and equipment costs



READY FOR JETS. When completed, Packard test cell will look like this—test J-47 jet engines built for U.S. Air Force.

LAYOUT FOR SECONDARY SELECTIVE SYSTEM. A 1500-kva double-ended load center, being installed, is typical arrangement for secondary selective distribution at Packard. Each transformer is 750 kva. High voltage is 4800 volts. Load center functions like two substations built into one, with tie circuit breaker between the two buses. Low voltage is 480Y neutral grounded.

# of Packard's new jet engine plant

Secondary selective system with 480Y-v grounded neutral assures low-cost power continuity

By using pre-assembled G-E load-center unit substations, Packard Motor Company was able to get a fast, inexpensive installation job on the power distribution system at its new jet engine plant in Utica, Mich.

Location of six load-center substations, arranged in pairs of three 1500-kva double-ended load centers, kept pace with construction of the plant bays themselves. A double-ended load center for auxiliary loads went into the power house even before it was completed.

The secondary selective distribution system chosen by Packard assures extreme reliability through its low-cost emergency tie, providing an alternate power source for the load area should either transformer go out. This system also saves cable, reduces operating hazards through low-voltage transfer switching, and permits removal of feeder, transformer, or main secondary breaker for maintenance without dropping service on either low-voltage bus.

For further information on G-E engineered load-center unit substations, call your local General Electric sales representative, or write for GEA-3592, General Electric Company, Schenectady 5, New York.

321-88

SIMPLE INSPECTION. G-E Type AK-1 breaker for low-voltage side pulls out easily for inspection. Big AL-2 breaker is to right center of others.

GENERAL ELECTRIC

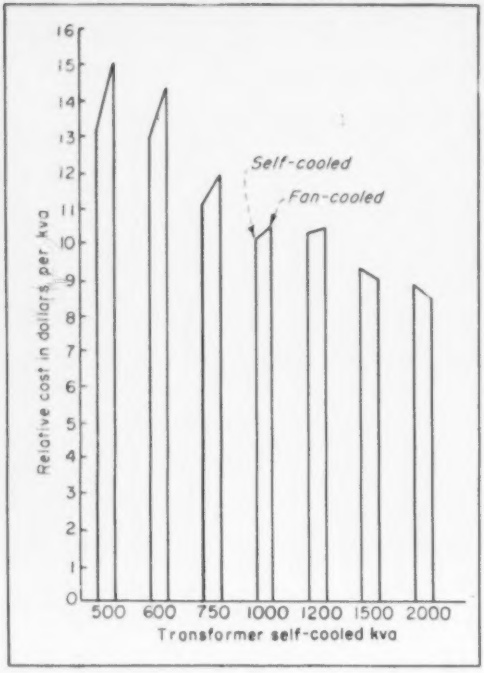


Fig. 1 **RELATIVE COST** of self-cooled and fan-cooled for typical 4160/480-v transformer. Other ratings will exhibit similar characteristics. Relation changes at 1500 kva

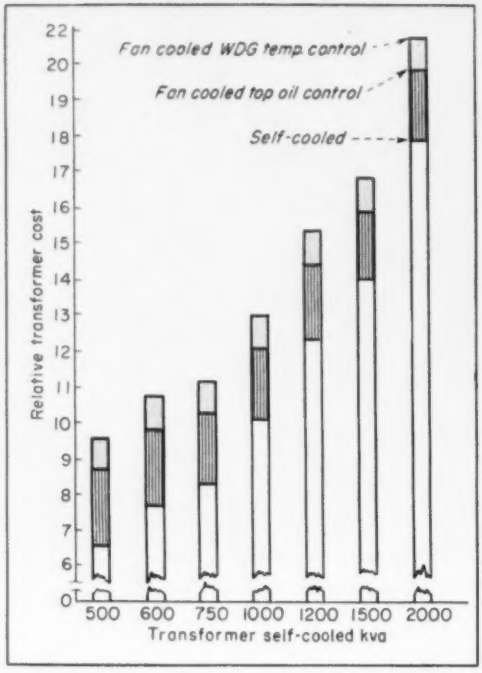

Fan cooled WDG temp control
Fan cooled top oil control
Self-cooled
Relative transformer cost
500 600 750 1000 1200 1500 2000
Transformer self-cooled kva

Fig. 2 **COST PER KVA** favors self-cooled for sizes up to 1,200 kva and fan cooled in 1,500 and 2,000-kva sizes. Each installation should be evaluated separately

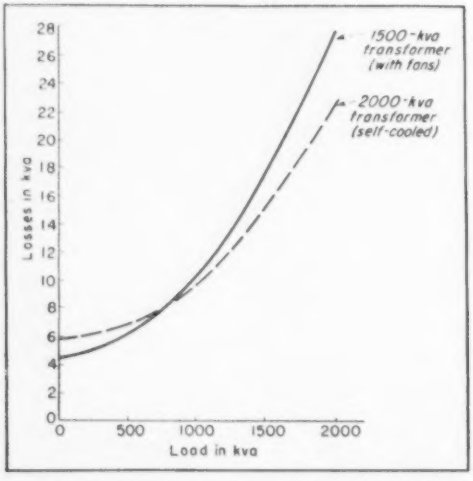


Fig. 3 **LOSSES** of 1,500-kva transformer with fans and 2,000-kva self-cooled transformer show that for loads above 1,000 kva the 2,000 kva transformer has lower losses than the 1,500-kva unit. Fan losses, estimated at 2% of full load losses, are not included in curves

Are Transformer Fans Justified?

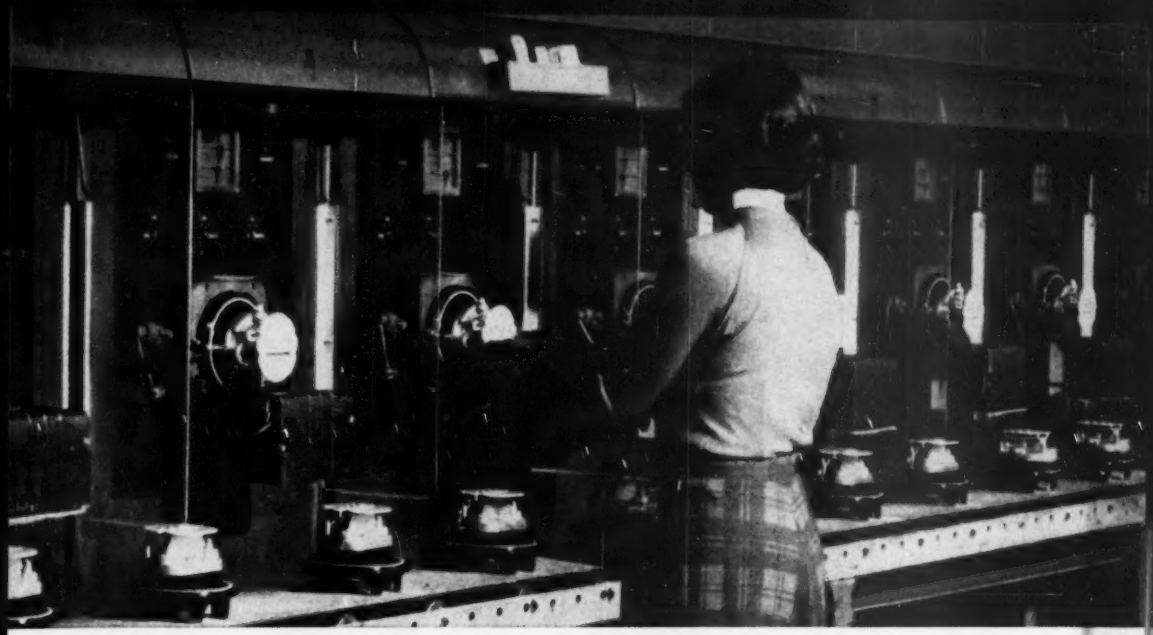
J. V. McGUIRE, Engineer, Allis Chalmers Mfg Co, Milwaukee

Fans on industrial transformers are not generally justified, even though many specifications call for them; fans automatically controlled from winding temperatures are sometimes specified. Fans increase transformer rating but they also increase installation cost. Usually the increase in cost is out of proportion to the increase in rating.

The usual industrial transformer is installed as a part of a load center unit substation. The complete range of standard ratings, for the class of equipment discussed here, is shown in table 1. It can be seen that dry type transformers have a greater increase in rating due to fans because the cooling air comes into direct contact with the windings.

One reason for specifying more fans on industrial transformers is that they are one of the few means of increasing the rating of an existing transformer installation. Since adding fans increases a transformer's rating by a percentage

(*Continued on page* 116)



G-E I-50 meters, in final factory test. I-50's save you metering costs in many ways. Here's how . . .

Unit Construction of G-E I-50 Meter Saves Calibration, Maintenance Costs

From cover to base, ***integral units*** of construction simplify the certified General Electric I-50 watthour meter. Because no movement of parts can take place within these units, calibration remains stable and the inherent I-50 accuracy is sustained.

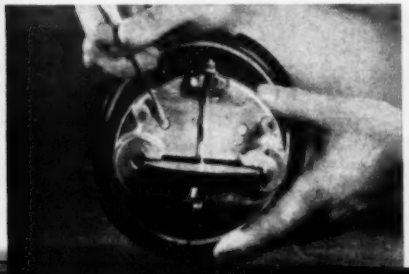
Result: As far as the certified I-50 meter *itself* is concerned, testing costs are reduced. Calibrating time is cut. The long-term stability of I-50 accuracy permits a longer time between periodic tests. Maintenance costs are lessened.

For more information on the savings offered by the certified I-50 watthour meter, call your nearest G-E representative. ***General Electric Company, Schenectady 5, New York.*** 601-89

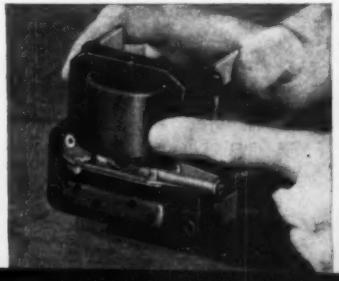
RETARDING MAGNETS of Alnico V are die-cast into frame, firmly fixing them to prevent movement, stabilize calibration.

GENERAL ELECTRIC

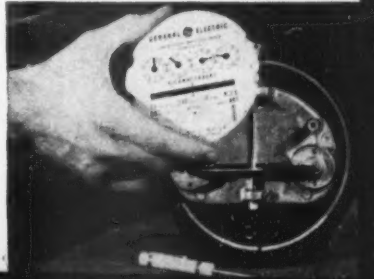
STURDY, ONE-PIECE FRAME aligns all operating parts. Four knurled rivets hold stator to frame and prevent movement.

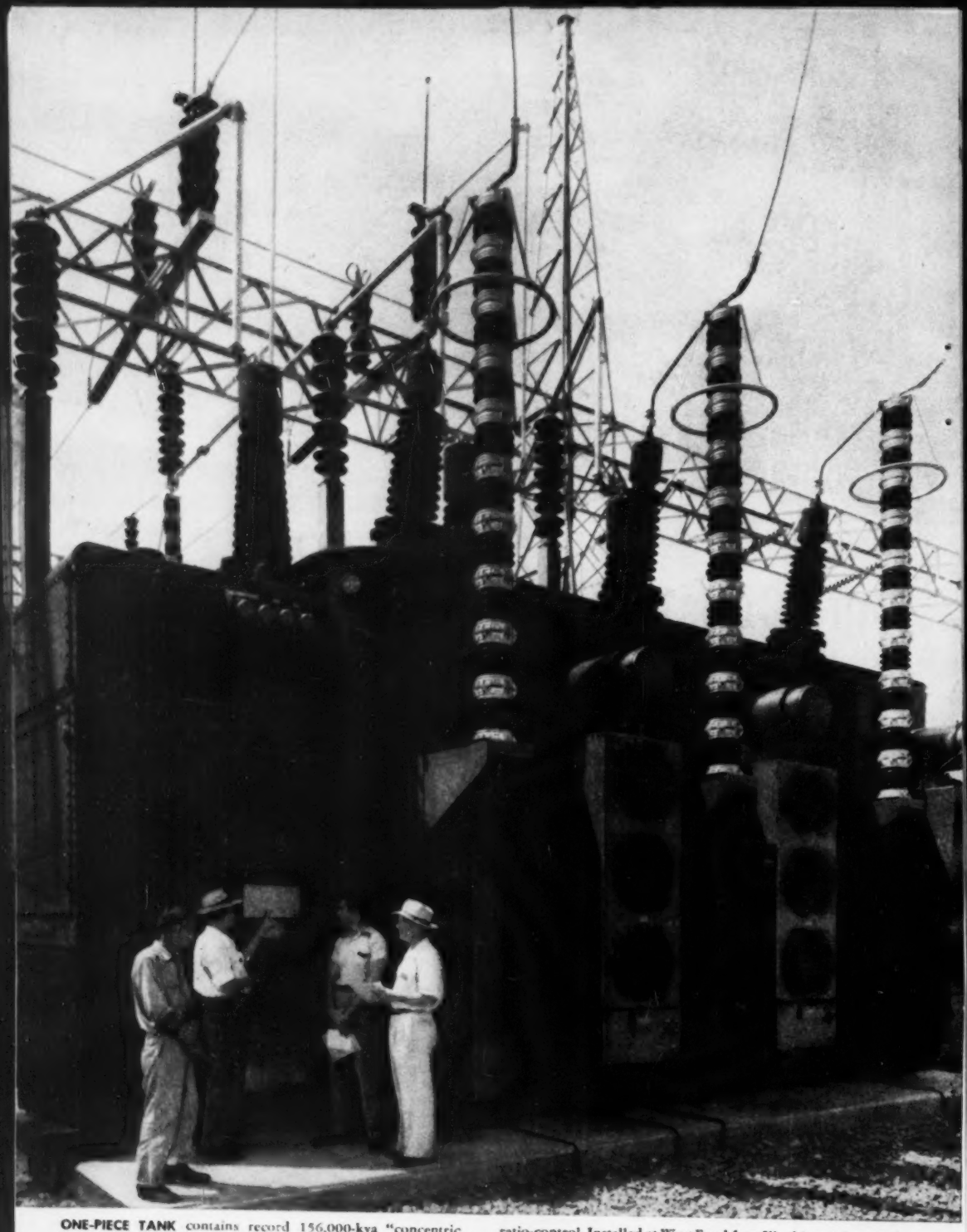


MOLDED COIL INSULATION securely holds coils to laminations, eliminates movement and calibration change in stator.



UNIT CONSTRUCTION OF REGISTERS— both pointer and cyclometer — gives mechanism having inherently low friction.





ONE-PIECE TANK contains record 156,000-kva "concentric layer" autotransformer and the series transformer for load-ratio-control. Installed at West Frankfort, Ill., this unit is cooled by the directed flow of forced oil through the windings and core.

230-kv "CONCENTRIC LAYER" autotransformer packs record 156,000 kva in one-piece tank

New unit for Illinois Power Company shipped upright in one-piece tank to minimize installation expense

Built for the Illinois Power Company of Decatur, Illinois, this G-E "concentric layer" autotransformer rated 156,000 kva (output) will tie a 230-kv system to a 138-kv system to help supply power for an atomic energy plant at Paducah, Kentucky.

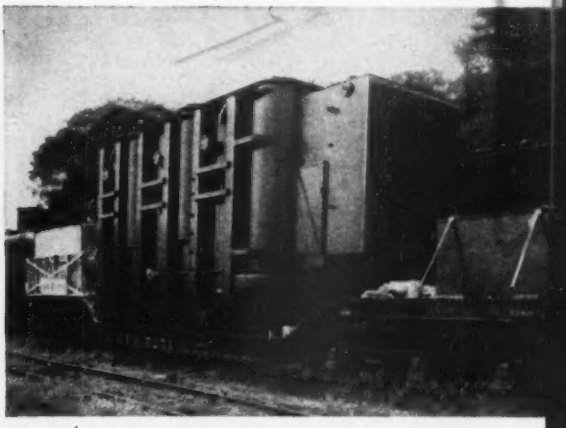
Weight, size held down. The use of "concentric layer" high-voltage windings permitted the entire core and coil assembly, including the load-ratio-control series transformer, to be fitted into a one-piece tank which was small enough to be shipped upright, ready for installation.

In this winding, the conductor is wound in concentric layers separated by cylinders of insulation. These layers are connected in series so that voltage stresses between the layers and between high- and low-voltage windings are only the voltage of one layer. Bulky insulation between high- and low-voltage windings is not required since the necessary insulation is distributed efficiently throughout the winding. Weights and dimensions are substantially reduced permitting a larger kva unit to be shipped upright in a single-section tank.

High impulse strength is inherent in "concentric layer." There are no harmful oscillations under impulse because voltage distribution is essentially uniform throughout the winding. As a result, voltage stresses can be calculated accurately, and insulation applied precisely.

For power systems, 161 to 330 kv and higher. If you use or contemplate using 161 to 330 kv or above in high-capacity ratings, it will pay you to review the data on "concentric layer" design. Ask your local G-E Apparatus Sales representative for bulletin GER-129, or write to Section 401-36, General Electric Company, Schenectady 5, New York.

LOWER WEIGHT and smaller size of "concentric layer" design results from improved space factor—elimination of bulky insulation between low- and high-voltage windings.



SHIPPED UPRIGHT on a special drop-frame railroad car, this 156,000-kva "concentric layer" unit was installed easily without the use of cranes or other hoisting facilities.

GENERAL ELECTRIC

of its self-cooled rating, the benefit is small on small transformers. Because the cost of fans and their controls is relatively fixed, they are not recommended for transformers below 500 kva.

Fig 1 shows the increase in cost when fans are added to load center transformers of various ratings. It costs less to buy the next larger self-cooled rating than to buy fans for transformers up through 750 kva.

Cost per kva . . . Fig 1 is, in a sense, an oversimplified analysis of the economics of fans. To get a further insight into the problem, self-cooled and fan-cooled ratings are analyzed in Fig 2, on the basis of cost in dollars per kva for liquid-filled transformers with typical control of the fans. Dry type transformers would show a similar picture because the effects of greater increase in rating with fans would be offset by the higher cost of winding temperature control, usually used with dry-type transformers. Fig 2 shows fan-cooled kva costs more than self-cooled kva in all ratings up to 1,500 kva. This makes 1,500 and 2,000 kva the only ratings on which fans seem at all economical.

Losses . . . Fig 3 compares losses of a 1,500-kva transformer with fans and a 2,000-kva self-cooled transformer. Power to drive the fans, usually estimated at 2% of the full load losses, has not been included in these curves.

Standard Ratings of Load Center Transformers

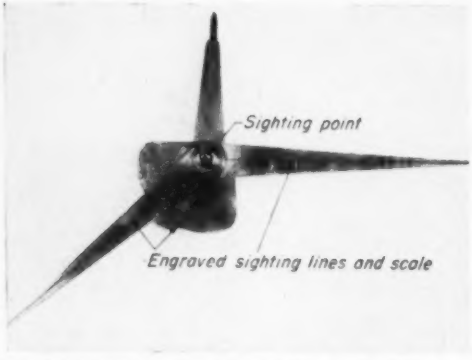
High Voltage 2400	KVA Self Cooled	Forced Air-Cooled Liquid	Forced Air-Cooled Dry	Low Voltage
4160	112½	——		208Y/120
4800	150	——		240 delta
7200	225	——		480 delta
12000	300	——		480Y/277
12470	500	575	or 667	600 delta
13200	750	863	or 1000	
14400	1000	1150	or 1333	
	1500	1725	or 2000	
	2000	2300	or 2667	

For loads above 1,000 kva, the 2,000-kva transformer has lower losses than the 1,500-kva unit.

Costs of load losses vary with the power rate charged but the curves show losses must be considered in the analysis. Other factors that deserve consideration are maintenance costs and noise. The fans and their control will probably require more maintenance than the transformer itself and there is an increase in noise level.

These graphs indicate fans should be applied to industrial transformers only after a careful analysis of the individual application. They should not be used on transformers 750 kva and smaller. Even the larger ratings should be checked before fans are specified since their use may not be justified.

FINDING LINE ANGLE is a matter of taking two sights. Laying of base lines is unnecessary as is slide rule computation



LINE PROTRACTOR consists of brass sighting arms and steel arm ending in a case-hardened screw chosen of proper length

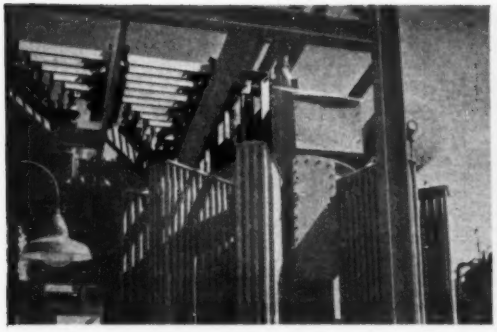
Read Line Angles Quickly With Protractor

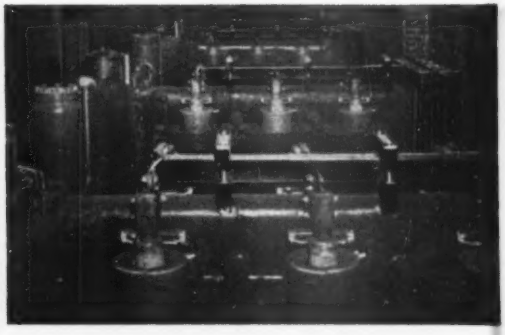
A simple line-angle protractor saves up to 15 min per angle over the previous method of determining angles by measurement of base lines and calculations involving a slide rule and trigonometric functions. This pocket-sized device is used by San Diego Gas and Electric Co field engineers on distribution line reconstruction where guy tensions at line angles are recomputed to determine proper guy strength and anchor holding power. It is also used to a limited extent on new construction.

Protractor consists of two adjustable brass arms attached to a third steel arm by a stud that is machined to form a sighting point. A 0 to 90-deg calibrated scale is engraved on one arm and sight lines are engraved on both brass arms. In use the brass arms are aligned into position as a foresight and backsight. A bevelled notch in the upper arm at a position opposite the calibrated scale in the lower arm permits interpolation of scale readings in 15-min increments. Steel arm terminates in a case-hardened screw of such a length as not to destroy the effectiveness of the pole's preservative treatment by gouging too deeply.

To use the protractor the engineer screws it into the pole at the approximate vertex of the angle. Then he takes a foresight and backsight on adjacent poles and records the angle. Usual distribution span lengths are such as to make parallax errors negligible.

It takes a Lot of Copper to make a Lot of Chemicals!





These photographs show a lot of copper bus bar in a new plant of a great chemical company, whose name and location cannot be disclosed. The copper carries heavy currents to electro-chemical equipment for the production of valuable products used in national defense and in industry. Revere furnished 325,000 pounds of bus bar for this service, the bar going into substations, rectifier stations, and cell houses. In addition, at the time of installation the Revere Technical Advisory Service collaborated with the customer in working out some difficult details in the design of switches. If you need electrical conductors, remember that copper has the highest electrical conductivity of all the commercial metals, that Revere makes bus bar, and that the Revere Technical Advisory Service is always ready to work with you on any problem concerning copper and its alloys or aluminum alloys. Call the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere

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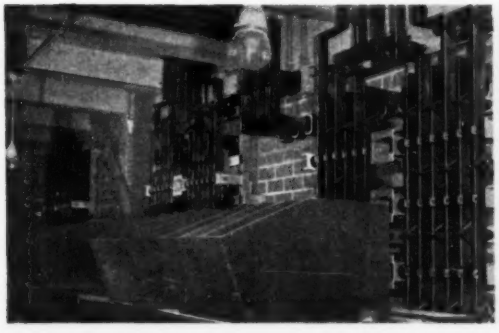
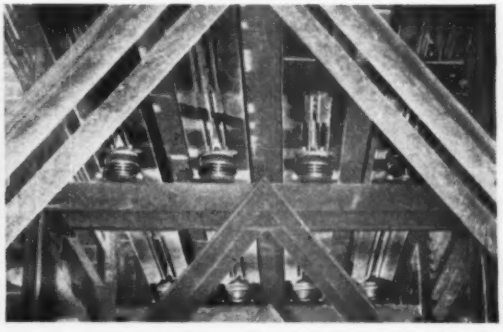
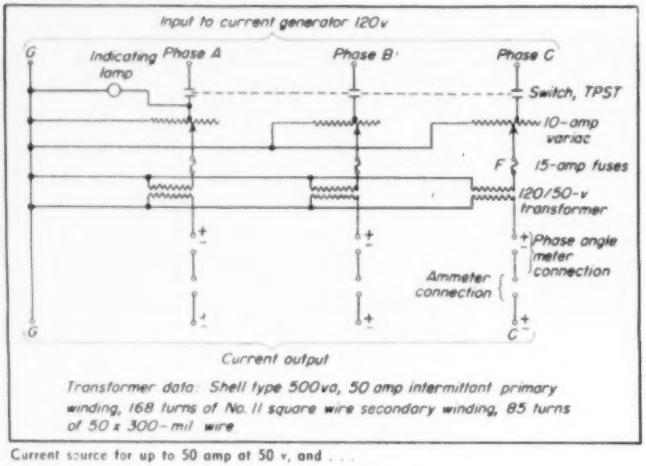




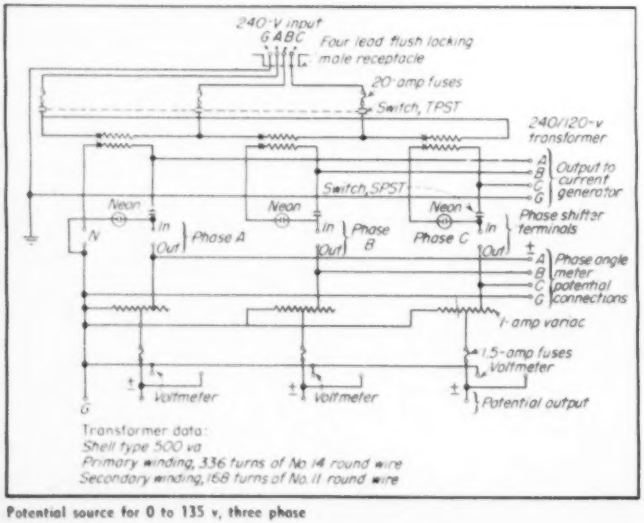
Portable test board includes . . .

Check Relays With Portable Current and Voltage Supply

High-speed impedance relay circuits are checked throughout Idaho Power Co's system with a three-phase test board which is shipped by common carrier from place to place as necessary. Designed and built by Idaho Power, board is especially useful on circuits such as directional relay banks and three-phase metering installations. Its primary use is in checking relay circuits in substation switchboards to insure their being correct before the station is energized. Transformers were wound in Idaho Power's Transformer Shop, the remainder of the work was done in their Engineering Shop.



Current source for up to 50 amp at 50 v, and . . .



Potential source for 0 to 135 v, three phase

Separate sources of potential and current to simulate output of current and potential transformers are provided by the board. Each source is housed in a steel box. Potential source contains the main 240/120-v power bank and a set of 1-amp Variacs which supply three-phase potentials from 0 to 135 v. Current source holds a set of 10-amp Variacs and a bank of 120/50-v transformers to provide current up to 50 amp.

Proper phase relationship is attained through a phase shifter in the potential circuits and is checked by a portable phase meter. Complete board, plus multi-conductor cables for input and output and a folding table, weighs about 500 lb. Table has large rubber casters to facilitate movement in shop or switchboard room.

When board is sent up for tests, potential source unit rests edgewise on the back of the current source unit. By mounting the 120/50-v transformers to the rear of the current unit, a space was made for the potential unit. Power transformers in the potential unit are mounted to be at the bottom when the unit is on its side to provide a lower center of gravity. Result is better stability when the entire set is moved on its table.

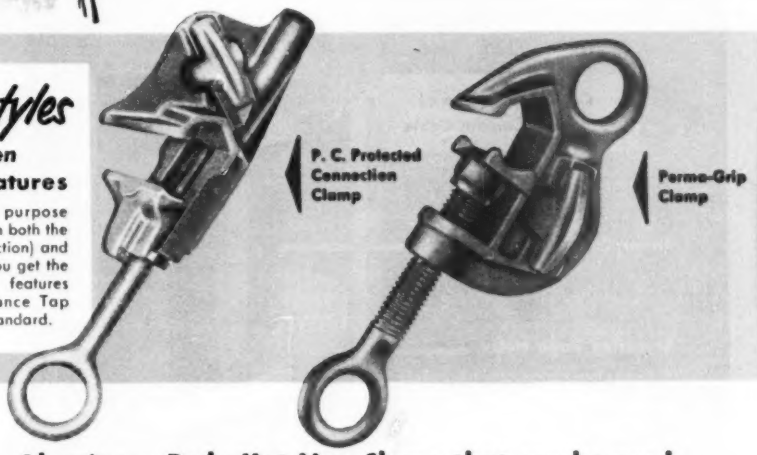
Handles are attached so that the units balance well when carried. Removable covers protect the control panels during shipment. Idaho Power reports this equipment has been shipped many hundreds of miles by common carrier but has never failed.

Here's the solution!

CHANCE *Aluminum General Purpose* Hot Line Clamps

Two body styles with proven mechanical features

These new general purpose clamps are available in both the P.C. (Protected Connection) and Perma-Grip design—you get the same *service proved* features that have made Chance Tap Clamps an industry standard.



NOW... an Aluminum-Body Hot Line Clamp that can be used for all types of connections

These new Chance multi-purpose tap clamps are the result of a newly-developed method of coating aluminum with a high-density fortified cadmium.

The strong cast aluminum bodies are *light in weight*—easy on the conductor because they reduce conductor fatigue—easy to handle on a clamp stick. Contacts stay *tight* — the thermal expansion of the clamp is uniform with aluminum conductor . . . and, since the thermal coefficient of copper is less than that of aluminum, the clamp will not *deform* copper conductor even under extreme temperature variations. The conductor is protected at all times.

The cadmium coating—fortified with chromium chromate for extra long life—wards off corrosion and electrolysis in all types of connections . . . aluminum to copper, aluminum to aluminum, copper to aluminum, and copper to copper. With Chance Aluminum General Purpose Clamps you can eliminate confusion and the chance of error in connector applications—you can reduce inventories — and you can greatly simplify stocking problems.

You know it's RIGHT when you specify CHANCE

ABC INDUSTRIES

A·B·CHANCE CO·

CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

In addition to these two complete lines, Chance Parallel Groove Clamps are also available in cadmium-coated aluminum for general purpose connections.

C52-16

NEW *Styroflex* COAXIAL

provides high-power, low-loss communication links

Cut-away Section of Styroflex Coaxial Cable
Inner Copper Conductor
Styroflex Tape Helix
• Keeps inner conductor absolutely and permanently centered, even at sharp bends.
• Provides a uniform combination of solid and air dielectrics at every cross-section of cable.
Outer Belt of Styroflex Tape
• Increases leakage path between inner conductor and outer aluminum sheath.
Outer Aluminum Sheath
• Consists of continuous aluminum tube without joints.
• Acts as outer conductor.

Typical TV antenna installation of Styroflex coaxial cable as a power line from station transmitter to antenna.

CABLE BY PHELPS DODGE

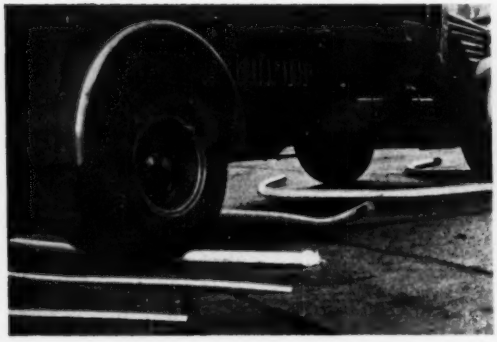
in semi-flexible 1000-ft. lengths without joints!

Reflections Reduced to Absolute Minimum in AM, FM, TV and Microwave Applications

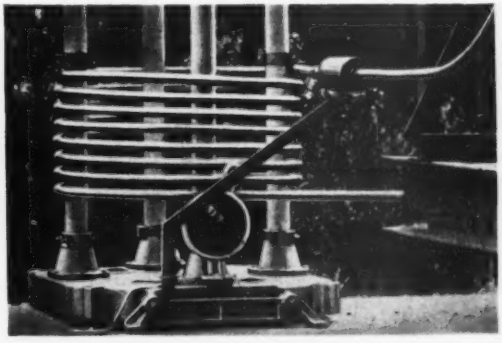
Phelps Dodge Copper Products Corporation's new semi-flexible, aluminum sheathed Styroflex cable is specially designed to meet the need for a high-power, efficient low-loss coaxial cable in the AM, FM, TV and microwave fields. The cable reduces reflections—which cause ghost images in television and distortions in communications—to an absolute minimum.

It was developed by Felten & Guilleaume Carlswerk, of Cologne, Germany, which has made a great many successful installations of the cable throughout Europe. Phelps Dodge is currently making the cable for sale in the United States in standard American sizes and impedances under a working agreement with the Cologne firm. The cable is manufactured in continuous 1000-foot lengths, without joints, and shipped on reels.

Outstanding feature of the cable is the use of insulating Styroflex film to form a helix. This helix, built up of hundreds of precision-wound Styroflex tapes, firmly supports and centers the inner conductor coaxially in an aluminum sheath at all times, assuring retention of excellent electrical properties. Essential flexibility of the Styroflex tape is obtained by special manufacturing techniques.



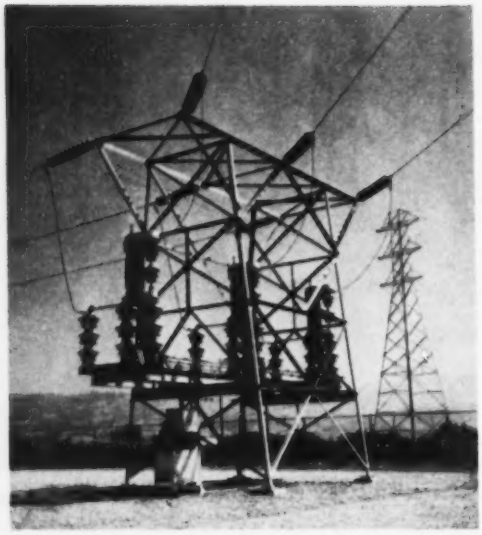
* In test of strength and ruggedness of Styroflex coaxial cable, heavy truck drives over several samples without damaging them.



* Perfect centering of inner conductor is maintained by Styroflex tape helix, regardless of bending or load cycling both during installation and in service.

PHELPS DODGE COPPER PRODUCTS CORPORATION

40 WALL STREET, NEW YORK 5, N. Y.



LOAD INTERRUPTERS at Green Valley substation of Coast Counties Gas and Electric Co provide interrupting capacity of 500 Mva for 110/24-kv transformer bank at one-third initial cost and one-third installed cost of oil circuit breakers. Units are rated at 350 amp

Interrupter Switch Gives Economical 110-Kv Operation

New type of load interrupter switch provides economical and reliable switching for transformer protection and switching at 110 kv on the system of Coast Counties Gas and Electric Co, Santa Cruz, Calif. The utility's decision to use this type of switch is based on these factors:

1. Cost of the load interrupter is about one-third that of the smallest oil circuit breaker available at this voltage, with installation costs also about one-third.

2. Load interrupter provides ample interrupting capacity up to 500 Mva.

3. Load interrupter is fully automatic, complete with motor operator and spring tripping mechanism for 20-cycle tripping, and can be used in a conventional transformer differential relay scheme up to the interrupter rating.

4. Load interrupter affords the same degree of flexibility as an oil breaker for switching a transformer bank.

Interrupter switch is essentially a three-pole, group-operated, rotating insulator, vertical airbreak switch with an interrupting contact in series with each switch blade. Interrupting contact is designed to open prior to opening of the airbreak switch. Interruption of the current is made under oil and the arc is quenched by an oil blast.

Operating mechanism of the switch is similar to that of a conventional airbreak switch and may be actuated manually, by motor mechanism, or by a spring-opening mechanism which is rewound by motor or manually. Motor mechanism is trip-free in any position of the closing stroke. Automatic protection by relays is accomplished by the spring-opening mechanism actuated by a dc trip coil.

Coast Counties has installed load interrupters on four 110/24-kv transformer banks at two load centers. At Green Valley substation, a 110-kv bus is fed by two incoming lines through oil circuit breakers. A 20,000/33,333-kva, 110/24, 3-phase transformer bank, and a bank of three single-phase, 10,000/13,333-kva, 110/60/24-kv transformers are connected directly to the bus through two 115-kv, 350-amp load interrupters with interrupting ratings of 500 Mva. At the new Paul Sweet substation, two 3-phase, 20,000/33,333-kva, 110/24-kv transformers are connected to separate 110-kv lines without the benefit of a 110-kv bus. Load interrupters of the same type but with interrupting ratings of 250 Mva are used on each bank. Load interrupter switches were obtained from Schwager-Wood Mfg Corp, Portland, Ore.

Easy Equipment Handling

Handling equipment on the job is easier with the special rubber-tired dolly developed by the distribution department of Dallas Power & Light Co.

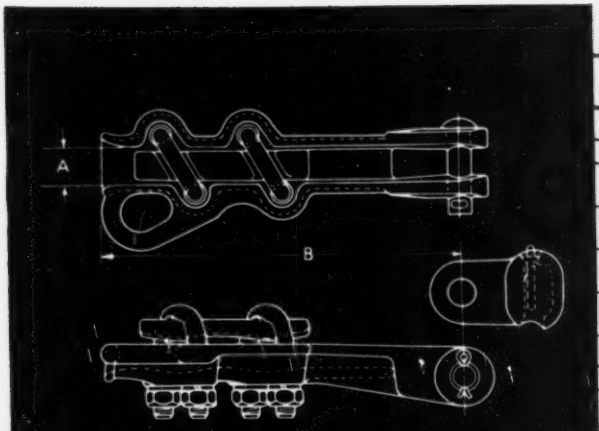
The dolly is used by line crews for transporting transformers and other heavy equipment to locations not accessible by truck such as easements and blocked alleys. Advantages are:

1. Reduces the possibility of back strain caused by carrying heavy equipment.

2. Makes the job of transporting heavy equipment easier and faster.

3. Prevents damage to lawns and walks when equipment has to be transported over private property.

The unit is of welded construction and is made from steel tubing, strap iron and steel plate. The axle is 5/8" alloy steel. The wheels are General Pneumatic 10x3.50x4 —5/8 axle. The completed dolly is painted to prevent rusting.



NEW LINE OF CLAMPS FOR DISTRIBUTION FEEDERS

Catalog Number	Connector	Conductor Dia. Inches (A)	Length Inches (B)	Ultimate Strength Pounds
	MALLEABLE IRON			
87652	none	0.15—0.37	4½	7,000
87662 87663	none socket	0.30—0.60	8¼	8,000
87672 87673	none socket	0.46—0.86	9¼	8,000
87682 87683	none socket	0.65—1.25	11	8,000
87692 87693	none socket	0.86—1.55	12½	10,000
	ALUMINUM			
87650	none	0.15—0.37	4½	4,000
87660 87661	none socket	0.30—0.60	8¼	5,000
87670 87671	none socket	0.46—0.86	9¼	8,000
87680 87681	none socket	0.65—1.25	11	8,000
87690 87691	none socket	0.86—1.55	12½	10,000
	BRONZE			
87654	none	0.15—0.37	4½	7,000
87664 87665	none socket	0.30—0.60	8¼	8,000
87674 87675	none socket	0.46—0.86	9¼	8,000
87684 87685	none socket	0.65—1.25	11	8,000
87694 87695	none socket	0.86—1.55	12½	10,000

. . . THE O-B STRATELINE

Here is a deadend clamp that offers you an ideal combination for handling cable sizes used in modern distribution feeder construction: (1) Many years of successful service experience. (2) Cable diameter range, in five progressions, from 0.15 to 1.55 inch. (3) Slip strength safety factors of at least three for the usual design tensions used in distribution cables. (4) Short length and slender shape for close phase spacings. (5) Easily taped if desired. (6) Convenient application of safety coverings for hot line work. (7) Catalogued in aluminum, bronze, or malleable iron construction. (8) Exceptionally low cost.

If you want these characteristics in a deadend clamp for modern distribution feeders, specify the O-B Strateline.

Ohio Brass

MANSFIELD OHIO, U.S.A.

4244 H

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Chemical Treatment of Right-of-Ways

Results obtained by eight electric utilities using chemicals for elimination of woody growths, weeds and grasses along transmission rights-of-way, after first or initial clearing. This summary is an adaptation from a report by the Transmission and Distribution Committee of the Pennsylvania Electric Association.

Company	A	C	D	E	I	J	K	L	Summary
BRUSH (WOODY SPECIES)									
1. Number of acres that have been treated one or more times.	5003	348	305 once 386 twice	1498	2048.4	4390	2000	8675	24,725.4
2. In your opinion, what method is most effective?	Spray water base & oil base; basal during growing season	Basal	Original; 2nd treatment 3rd year; every 6th yr thereafter	Ammate foliage spray	Basal	Basal bark treatment with 2,4-D & 2,4,5-T in fuel oil	High volume foliage spray	Foliage Spray	4 Basal 3 Foliage
3. Do you treat, using your own crews?	No	No	No	No	No	Yes, limited	Yes	No	6 No; 2 Yes
4. Do you treat, using contractors?	Yes	Yes	Yes	Yes	Yes	Yes, mostly	Yes	Yes	8 Yes
5. Do you spot check concentrations used by contractors to assure that you are getting your money's worth?	Yes	Yes	No; Check results of spraying	Yes	Yes	Yes	Yes	Yes	7 Yes; 1 No
6. Which gives the best root kill, applied to: (a) Foliage (b) Basal	A	B	A	A	B	B	B	B	5 B; 3 A
7. What month do you consider most effective for spraying?	June, July August	June 15 to August 15	June 15 thru July 15	June, July August	July	—	June	June 15 to August 15	June through August
8. What is the best time to treat root sprouting species such as Sumach and Aspen?	June; July August	June	—	June; July August	June	Don't know	Foliage spray July	June 15 to August 15	June through August
9. What woody species are most difficult to kill?	Ash, Oak Hickory Cherry Red Maple	Red Maple Briars	Red Maple Ash	Red Maple Sumach Elm Locust	Red Maple Ash, Oak Sassafras	Red Maple Ash Hickory Scrub Oak	Red Maple Ash, Oak Hickory	Basswood Ash Maple	Red Maple Ash, Oak Hickory
(a) How killed?	Spraying foliage, basal	Basal spray	Foliage Spray & re-spray	Ammate spray	Selective spraying	Basal	Foliage spray	Basal spray	Basal and foliage spray
(b) What chemical, methods, and concentration were used?	2,4-D & 2,4,5-T with water in oil	½ 2,4-D, ½ 2,4,5-T 4 gal acid in 100 gal oil	Ammate 1 lb per gal	1 lb Ammate to 1 gal water, foliage spray	1 part 2,4-D, 1 part 2,4,5-T to 9 parts fuel oil or water sprayed	6 lb 2,4-D & 6 lb 2,4,5-T per 100 gal No. 2 fuel oil; Basal; Low pressure	6 qt, 2 lb 2,4-D & 2,4,5-T 2 lb, 1 gal with 200 gal water; high volume foliage	Esteron, 2,4,5-T basal spray with Ashbaugh spray wand, 5% sol. with oil	2,4-D & 2,4,5-T with oil or water
(c) What time of year?	June thru August	Summer	June 15 thru Sept. 15	Summer months	June to September	July and August	June to September	Any time	June to Sept.
STUMPS (BASAL)									
1. Do you spray stumps?	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	7 Yes; 1 No
2. How soon after cutting?	Immediately	Immediately	Immediately	—	Immediately	Within 2 wk	Soon as poss.	Same day if poss.	Immediately if possible
3. What chemical, methods, and concentration were used?	Oil spray and Dow Brush Killer 2,4,5-T	½ 2,4-D, ½ 2,4,5-T Basal 4 gal acid in 100 gal oil	2,4-D and 2,4,5-T, 4 lb formulation 1 gal in 74 gal fuel oil	—	1 part 2,4-D, 1 part 2,4,5-T to 9 parts fuel oil sprayed or brushed on	2,4,5-T 4 lb ae acid, 4 gal 2,4,5-T to 100 gal No. 2 fuel oil	2,4,5-T and 2,4-D with oil	5% Esteron, 2,4,5-T in fuel or diesel oil	2,4-D and 2,4,5-T with oil
4. What kind of equipment was used?	Hand spray pack tanks	Power spray	Power spray	—	Truck carrier	5 gal Knapsack sprayer	5 gal Indian pack sprayer	Hand Spray	Hand or power spray
5. What results?	Good	Good	Very good	—	60% kill on first treatment	Very good	Good	75% to 90% control	Very good
6. In your experience, which is best: (a) Small volume and high concentration of chemical?	—	A	High volume	—	A	—	A	—	4 A
(b) Large volume and low concentration of chemical?	B	—	—	—	—	B	—	B	3 B
WEEDS AND GRASSES									
1. Do you attempt to eliminate weeds and grasses?	No	No	No	No	No	No	No	No	8 No
2. What methods do you find best to follow? (a) Mowing	—	—	—	—	—	—	—	—	—
(b) Spraying	If needed	—	—	—	—	—	—	B	Spray if needed
3. If you spray, what chemical and concentrations do you use?	2,4-D 2,4,5-T 1 gal per 100 gal water	—	—	—	—	—	—	—	—
4. Do the results justify the cost?	Yes	—	—	—	—	—	—	—	—

Methods and results by initial chemical clearing were presented in Electrical World, June 5, 1950, pages 116 and 117. Company designations are identical to those reporting above.

INSIDE
a 70,000 kva
SINGLE PHASE
Pennsylvania Power Transformer

Two sets of taps per coil assure excellent electrical and mechanical balance in the windings.

Heavy bracing on side frames and on clamping plates provides uniform clamping pressure on core and coils.

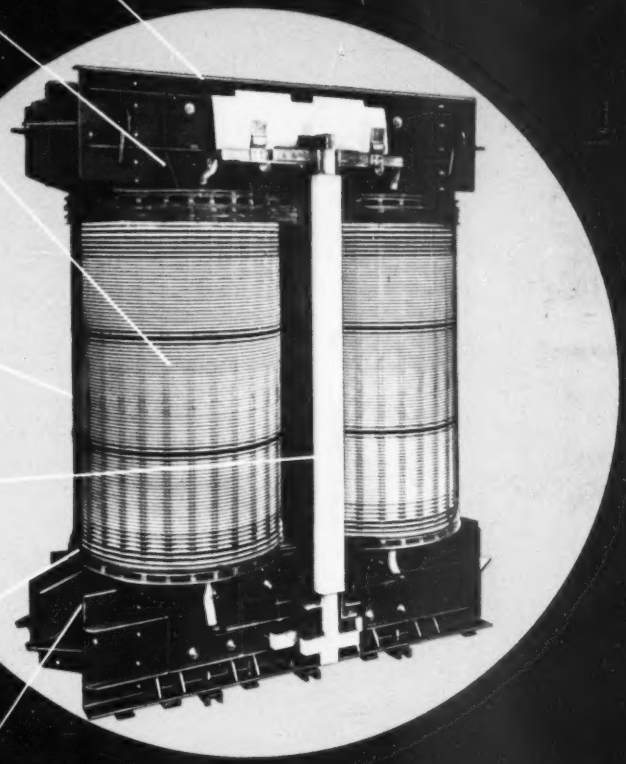
Continuous pancake winding in High Voltage coils. Helical winding in Low Voltage coils.

Coils are precompressed with force equal to highest short circuit stress and built into transformer at that compressed dimension. This prevents mechanical distortion of the coils if short circuit stresses occur.

Low Voltage leads from the coils are well supported and insulated in a pressboard tube.

Extra heavy insulation at line ends of coils. Graded insulation at ground ends of coils.

Rigid self-supporting bolted core contains a large number of cooling ducts for flow of oil across laminations.



70,000 Kva forced-air-cooled 56,000 Kva self-cooled. Single Phase, 60 Cycles, 55° C. Temperature rise. High Voltage: 93,000 161,000 Grd. Y volts. Low Voltage: 19,000 volts.

Pennsylvania Transformer Company

A McGRAW ELECTRIC COMPANY DIVISION

CANONSBURG, PENNSYLVANIA

Greater Pittsburgh District

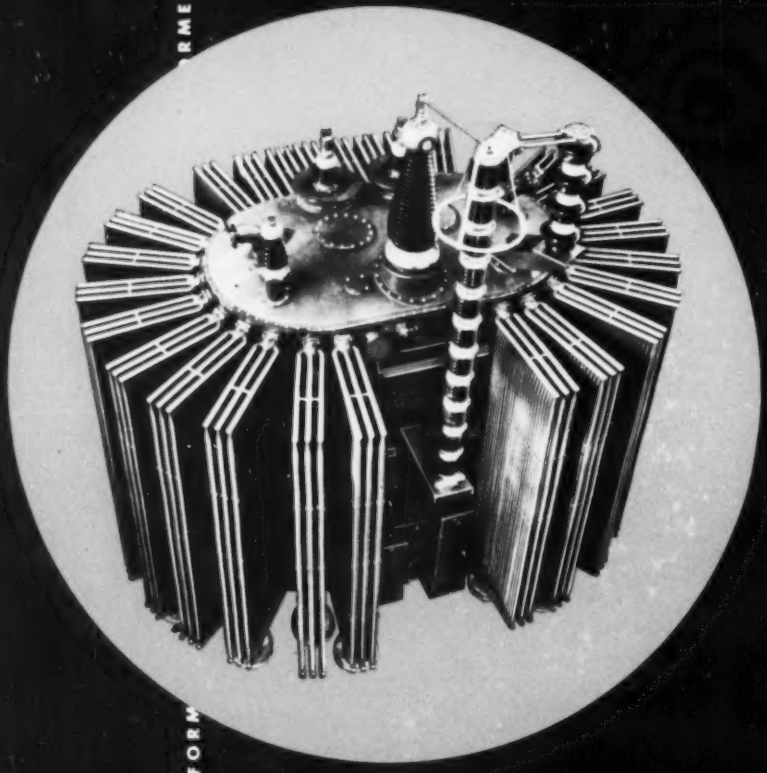
For exterior view of this transformer, see other side.

PENNSYLVANIA POWER TRANSFORMER PENNSYLVANIA POWER

70,000 kva

SINGLE PHASE

Pennsylvania Power Transformer



In addition to its forced-air rating of 70,000 Kva, this Pennsylvania transformer has a self-cooled rating of 56,000 Kva. Three of these transformers are connected in a 210,000 Kva bank to step up the generator voltage of 19,000 volts to the transmission voltage of 161,000 volts. The transformers were shipped to their destination in an upright position, completely assembled except for bushings and detachable radiators.

Pennsylvania Transformer Company

A McGRAW ELECTRIC COMPANY DIVISION

CANONSBURG, PENNSYLVANIA

Greater Pittsburgh District

For Inside Story See Next Page

Current Limiting Reactance Calculator Aids Switchboard Design

Low-voltage (600-v class) circuit breaker application studies can be facilitated.

AMADO CONANGLA, Electrical Engineer, I-T-E Circuit Breaker Co., Philadelphia, Pa.

Chart is used to determine: (1) Reactance in ohms per phase required in a 3-phase circuit to reduce the available short-circuit current to some definite value, or conversely, (2) reduction in short-circuit current effected by the insertion of additional reactance.

Following examples show use of the chart for above purposes.

Example 1. To determine the additional reactance per phase (X) required to reduce the short-circuit current from a value (I_1) to a smaller value (I_2).

Given. Available offset short-circuit current at a 480-v bus is 50,000 amp. That current must be reduced to a value that can be handled by a circuit breaker having an interrupting capacity of 15,000 amp.

Find. What is the reactance in ohms per phase required in a current limiting reactor to be installed between the bus and the breaker?

Solution. Join 50,000 on left-hand vertical scale with 15,000 on diagonal scale by a straight line and determine P on horizontal base line. Draw vertical line through P and at intersection of this vertical line with 480-v curve read 0.0162 ohm (right-hand vertical scale), which is the required additional reactance per phase.

Example 2. To determine effect of additional reactance in reducing short-circuit current.

Given. An air circuit breaker feeds a panelboard through a length of cable having a reactance of 0.020 ohm per phase. System voltage is 480 v, 3-phase. Short-circuit current available at the circuit breaker terminals is 30,000 amp offset.

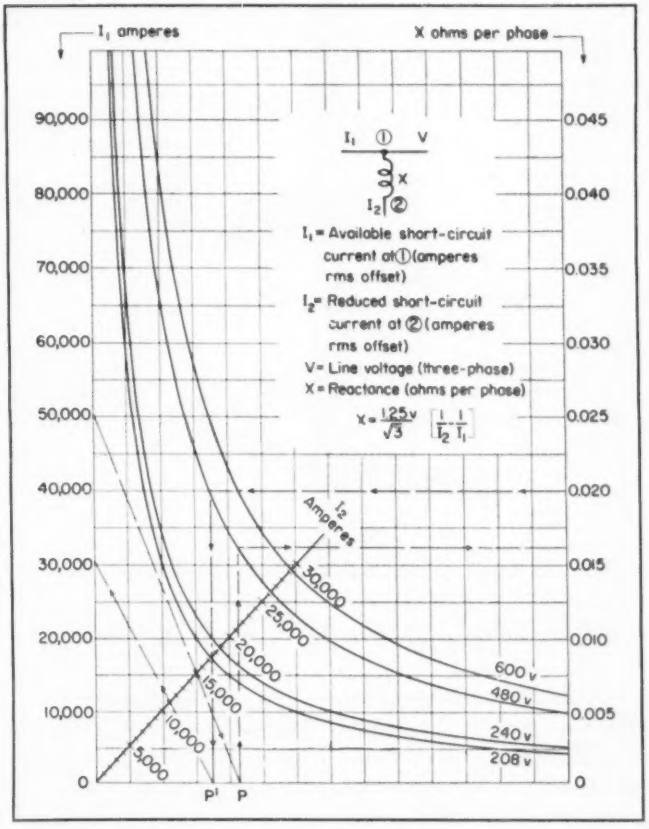
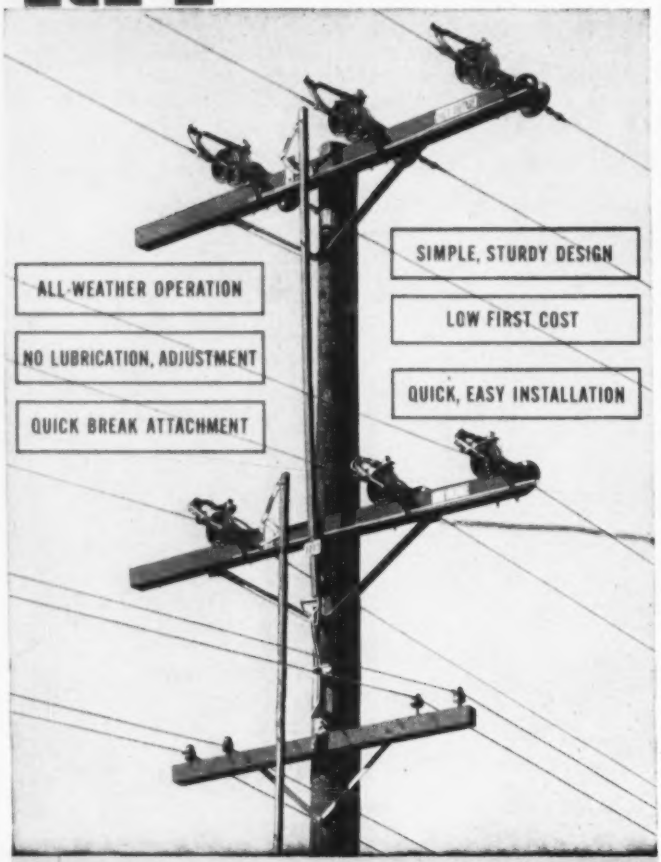


CHART is based on the formula shown, and on the assumptions: (A) That the resistance of the circuit is negligible, and (B) that the maximum short-circuit current corresponds to that obtainable on a 3-phase fault, including a factor of 1.25 to account for d-c component.

Find. What is the short-circuit current available at the panelboard?

Solution. Draw horizontal line through 0.020 on vertical right-hand scale. At intersection with 480-v curve draw vertical and determine point P′ on horizontal base line. Join P′ with 30,000 on vertical left-hand scale by means of straight line. On diagonal scale read 11,000 amp, the available offset short-circuit current at panelboard.

KPF POLE TOP SWITCHES



MORE SWITCH FOR LESS MONEY

KPF Pole Top Switches cost less to buy and give longer service because they are simplest in design, sturdily built. They need no separate deadends, no "extra" insulators. Simple "3-step" installation saves man hours—(just bore holes in cross-arms, tighten bolts, attach connectors). Insulator stacks easily adjusted for line sag. Free-floating, self-aligning, silver-surfaced blades always maintain proper contact. Vertical, horizontal or triangular mounting. Write today for Catalog, details of KPF switches.

2804

KPF ELECTRIC COMPANY
1624 E. Alpine Avenue • Stockton 5, Calif.

2-4 D AND 2, 4, 5 T, two lb each to the gallon of acid, mixed 1 to 24 in #2 fuel oil, gave a complete kill to light brush, mostly thornapple and elm shoots

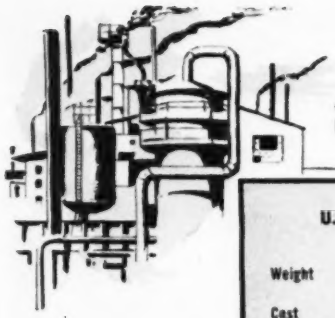
DEAD AND PEELING, these thirty-ft trees are elm, basswood, maple, beech, popple. Red dye in early batches showed translocation in early sap flow

Kill Brush With Basal Spray

KARL B. CRAWFORD, General Manager, Lorain-Medina Rural Electric Coop Inc, Wellington, Ohio

A 200-gal sprayer on a 1½-ton truck gave spraying pressure up to 400 lb and enabled two men to spray 63,000 lineal ft, average width 6 ft, on 39 days between February and May. Total cost figured down to $48 per 1,000 lineal ft. No complaints were received, no kill appeared in surrounding area.

Mixture of two pounds 2-4 D and two pounds 2, 4, 5 T, in ratio 1 to 24 with No. 2 fuel oil, gave broad results with variety plants and trees encountered. Next year, reclaimed motor oil will be used instead of fuel oil, to cut cost down further.

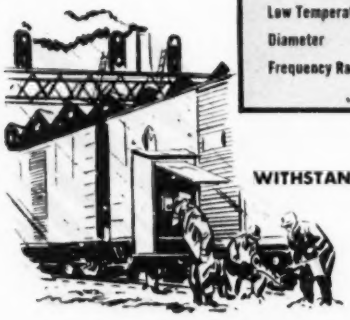


CHEMICAL RESISTANT

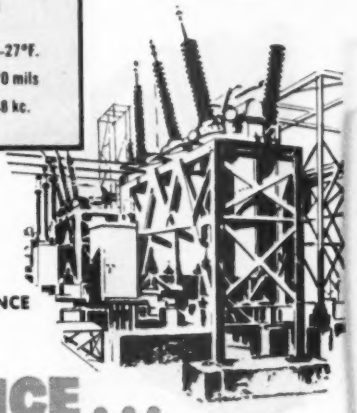
COLD RESISTANT

U. S. ARMY SIGNAL CORPS CARRIER CABLE

	OLD TYPE	NEW TYPE	GAIN
Weight	570 lbs. per mile	370 lbs. per mile	200 lbs. per mile
Cost	100% per mile	71% per mile	29% per mile
No. of Channels	4	12 and a supervisory channel	9
Low Temperature	—40°F.	—67°F.	—27°F.
Diameter	430 mils	360 mils	70 mils
Frequency Range	0-12 kc.	0-60 kc.	48 kc.



WITHSTANDS BURIAL



LOW MAINTENANCE COSTS

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at LOWER COST...
Specify Cable Jacketed with...

Vinylite BRAND PLASTICS

Make sure you've got the best in cable value — cable jacketed with VINYLITE Brand Plastic over BAKELITE Polyethylene cores!

Check the data above — the results of actual field tests. Note the savings in weight — in diameter. And note that old-type cable *costs 25% more* than cable jacketed and insulated with these materials!

What's more, this cable is *tough!* It stands up under bad weather, temperatures ranging from —67 deg. to 140 deg. F., contact with greases, oils, alkalies, and most strong acids. It has greater resistance to abrasion and impact.

With its thinner insulation and lighter weight, cable jacketed with VINYLITE Plastic over BAKELITE Polyethylene cores is easier to handle. Its smooth covering readily strips and facilitates splicing.

In military and civilian use alike, such cable is setting new records for lower cost, lower maintenance, greater service. Learn about it now.

For a list of suppliers, write Dept. NX-28.

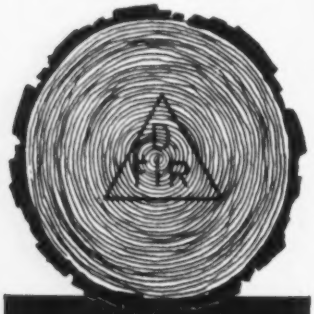
BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

MEMO TO WIRE MANUFACTURERS:
The new "Spiral 4" carrier cable developed by the U. S. Army Signal Corps, and geophysical cable used in oil and mining industries, are described in a new BAKELITE release, Kabelitems No. 60. These constructions have led to new designs in communication and control cables making use of BAKELITE Polyethylene insulation and VINYLITE Brand Plastic jacketing materials.

FOR LONG LIFE and low service cost, the big 3 in western poles are Western Larch — Lodgepole Pine — Douglas Fir.

All 3 are grown on the virgin forest lands of the J. Neils Lumber Company in western Montana. All 3 are produced and treated in J. Neils modern pole plant at Libby, Montana.

J. Neils Lumber Company, since 1895 a quality manufacturer of forest products, invites your inquiry on transmission and telephone poles. An illustrated folder on J. Neils treated poles, and information regarding their application to your own requirements, will be furnished on request.



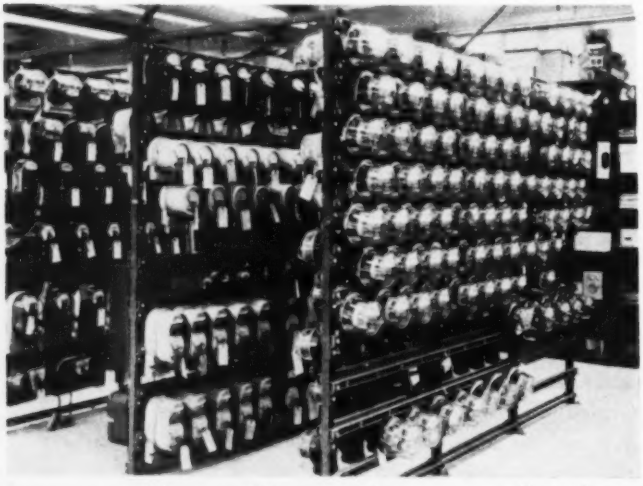
POLE DIVISION
J. Neils
Lumber Company
Libby, Montana

LIGHT WEIGHT CRANE mounted on swivel from old ladder truck moves ground rod rig

Swivel Crane Aids Driving Ground Rods

Time for driving ground rods has been reduced by Dayton Power and Light Company through the use of a swivel mounted boom for moving and handling the ground rod rig. The swivel was taken from an old street light maintenance truck. It was fitted with a small crane made by revamping a 1940 model aerial ladder. An air driven winch furnishes lifting power.

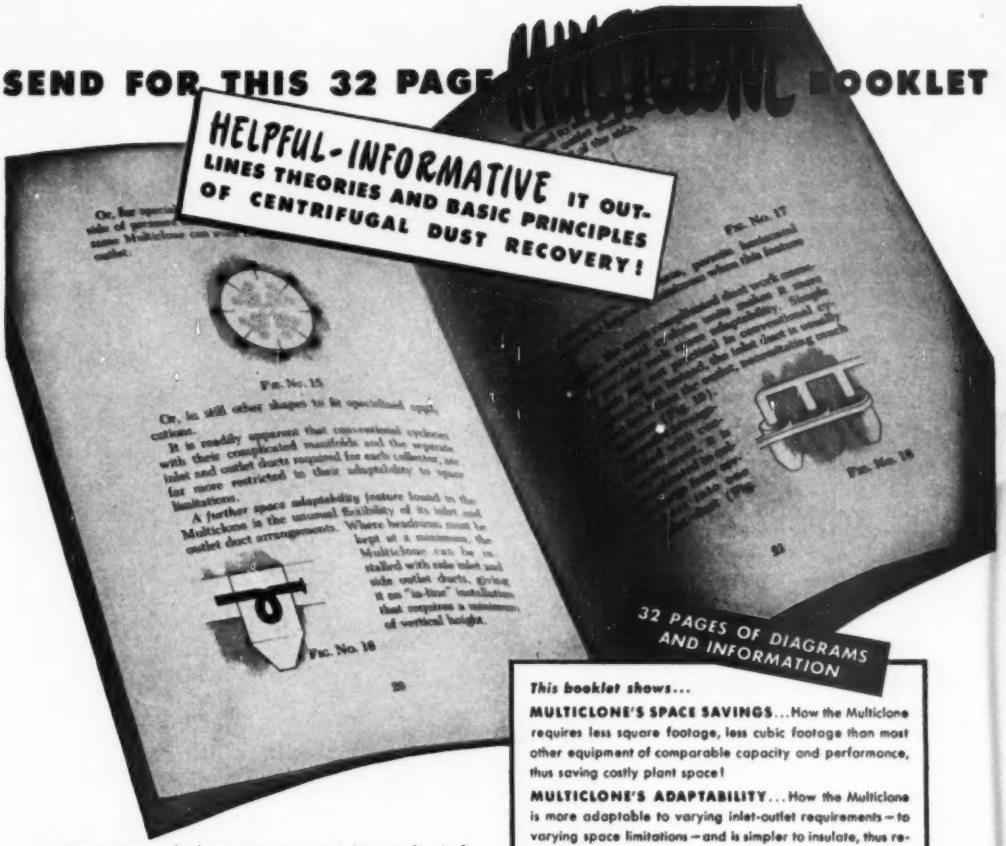
Lifting capacity of the crane at 8-ft radius is 750 lb. The ground rod rig is powered by a 38-lb breaker. 10-ft rods can be sunk to 100 ft.



Increase Meter Storage Space and Safety

A meter storage system that provides space-saving and time-saving, as well as safety and neatness, has been constructed by Blackstone Valley G&E Co, Pawtucket, R. I. The meter racks, using patented steel channels and fittings, are completely adjustable to provide for future changes. Each meter is hung on a special nut and screw so it can be slid to any position on the horizontal steel channel. Each section of the storage system racks 224 meters.

SEND FOR THIS 32 PAGE [illegible] BOOKLET


HELPFUL-INFORMATIVE IT OUTLINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL DUST RECOVERY!
Fig. No. 15
Fig. No. 16
Fig. No. 17
Fig. No. 18
32 PAGES OF DIAGRAMS AND INFORMATION

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

A limited supply of these booklets is available for free distribution to those interested in mechanical recovery equipment and methods. Write for your copy today.

This booklet shows...

MULTICLONE'S SPACE SAVINGS...How the Multiclone requires less square footage, less cubic footage than most other equipment of comparable capacity and performance, thus saving costly plant space!

MULTICLONE'S ADAPTABILITY...How the Multiclone is more adaptable to varying inlet-outlet requirements—to varying space limitations—and is simpler to insulate, thus reducing installation costs!

MULTICLONE'S EFFICIENCY...How Multiclone's multiple *small diameter* tubes, made possible by its exclusive vane design, give higher centrifugal forces and more complete cleansing of *all* suspended particles—even small ones of 10 microns and less!

MULTICLONE'S LOW MAINTENANCE...How the Multiclone has no high speed moving parts to repair or replace, no pads or filters to clean or renew, nothing to choke gas flow or increase draft losses as suspended materials are recovered. Multiclone draft losses remain uniformly low—recovery efficiencies uniformly high—at all times!

Make sure that a copy of this helpful booklet is in your reference files by sending for your copy now!

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PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

High-Ceiling F Fixture Relights Banking Area

From a height of 50 ft above the floor, slimline fluorescent (F) lamps provide comfortable light in the 50 x 75-ft main banking room of Howard Saving Institution, Newark, N. J. Light intensity maintained is a uniform level of 70 f-c in the employees' working area and 60 f-c in the patrons' area. Previous incandescent lighting provided intensities of 15-28 f-c and 2.5-30 f-c in the respective areas.

Believed to be the maximum mounting height at time of installation, the louver-shielded lighting "fixture" is in a 23 x 38 ft ceiling area. This area was occupied by a stained glass window.

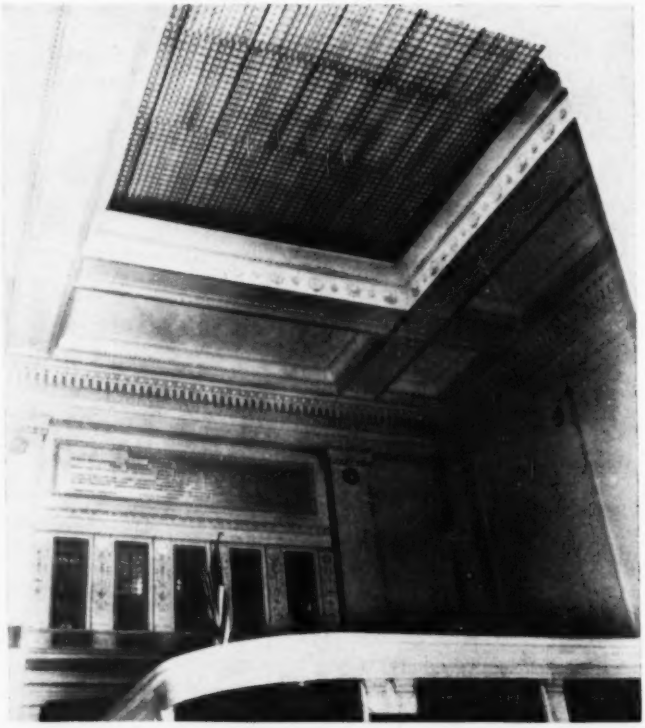
The custom-made fixture has a total of 275 type F, 96-in., T-12 lamps (430 ma, 75 w) in 55-lamp rows and in the five bays between socket wiring channels. By mounting the lamp rows on 7 ft 6 in. centers, lamp ends for one bay project 3 in. beyond the lamp ends for an adjacent bay.

Demarcation Eliminated . . . This staggered positioning of the lamp end eliminates demarcation shadows on the louvers.

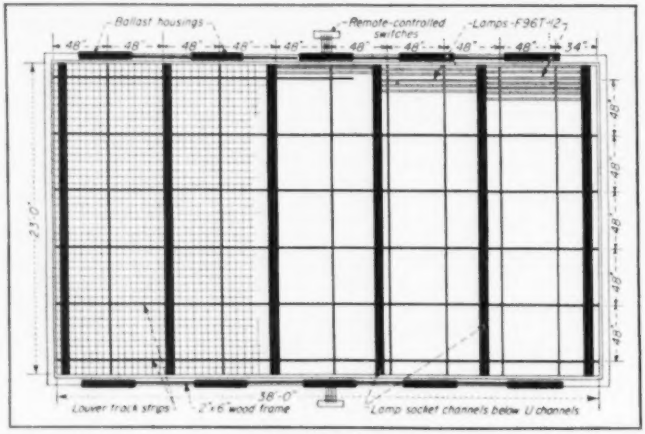
The louver panels are anodized aluminum with 6 x 6 x 3 in. cells. They are mounted below the lamps and on aluminum tracks. Their tops are 9 in. below U-channels carrying the lamp socket channels.

Reflectors are specular alzak aluminum in 4 x 7 ft sizes with simulated troffers. They are installed above the lamps and are removable for relamping from above.

To facilitate maintenance, the lead-lag type ballasts are mounted in 10 ballast housings, five on both long sides of the fixture area. Each housing contains 13 two-lamp and one single-lamp ballast and provides service for one-half bay. Four magnetic switches feed the ballasts and divide the lamp area into four sections with alternately staggered lamp positions. These switches are controlled from four push buttons located on the ground floor of the bank. With this control system, either all or only one-half of the lamps in each bay may be energized.



LIGHTING FIXTURE on 50-ft high ceiling has 23 x 38 ft louver, 275 slimline 96 in. T-12 fluorescent lamps and aluminum reflectors, provides 70 f-c at employees' work level



LOUVER SECTIONS, and lamp, ballast, and switch arrangements are shown for ceiling light installation in the 50 x 75 banking room

6 BIG REASONS WHY VICTOR PURIFIED PORCELAIN SWITCH and BUS INSULATORS ARE BETTER!

VICTOR NO. 742 (NEMA TR-No. 7). For complete engineering data on all Victor Switch and Bus Insulators, send for Bulletin No. 5.

1. Improved thermal resistance. Purified Porcelain, pure porcelain all the way through, expands and contracts more uniformly during sudden temperature changes.
2. Unmatched porcelain hardness and density, resulting in rock-like strength.
3. Higher average puncture values.
4. Better tension, torsion, cantilever and impact values.
5. Smoother, harder glaze with unequalled self-cleaning characteristics.
6. Finest insulator porcelain ever made—uniformity of quality never before achieved!

Specify VICTOR SWITCH and BUS INSULATORS

VICTOR INSULATORS, INC., VICTOR, N.Y.

San Diego Bureau Celebrates 20th Year

Commemorating the 20th anniversary of the Bureau of Home Appliances of San Diego County, a banquet highlighting the future of television and other electrical appliances climaxed the observation of Electrical Living Week recently throughout San Diego County. The week-long celebration was ushered in by a telecast of the addition of a 66,000-kw turbogenerator to the system of San Diego Gas & Electric Co. Promotional activities featured posters and banners in appliance stores and interviews and spot announcements on the radio and television stations.

A bright future for electrical appliance manufacturers was forecast by John C. Sharp, Hotpoint Co president, and Dr. Allan B. DuMont, president of DuMont Television Co, before over 700 people attending the dinner. Speculating on the future, Sharp pointed out areas of electrical living that have been rarely scratched. With the acceptance of home air conditioning, advanced automatic cleaning equipment, dehumidifiers, electric heating, etc, dirt in the home will become a thing of the past. In the field of home lighting it will be necessary to educate the public to accept higher light levels to make working and relaxing in the home more pleasant.

Bright Future . . . The public will have color television in five to ten years, predicted Dr. DuMont. At the present time the color picture produced by an all-electronic method is not too crisp and must undergo further refinement. However, he estimated that the number of receivers will grow from 18 million today to between 40 and 45 million by 1956 and that broadcasting stations will climb from the present 108 to between 700 and 800 during the same period.

In the next five to ten years television will be in general use by industry to monitor and control processes, Dr. DuMont said. This includes three-dimensional television, which is being used by the Atomic Energy Commission today.

Accomplishments Listed . . . Notable "firsts" among the Bureau's achievements over the last 20 years was the subject of a novel sound-slide film presentation during the banquet.

Introduced by Dan Turner of San Diego Gas & Electric Co and present director of the Bureau's sales training division, the film was shown on a large mock-up of a television screen.

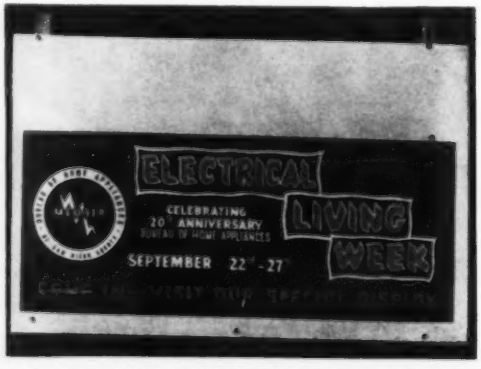
Combining hit songs and notable news events of the past two decades, the presentation noted outstanding Bureau activities.

J. Clark Chamberlain, secretary-manager of the Bureau since its organization, received a certificate in recognition of his 20 years of service. Also cited were Gordon Dawson, immediate past president, and Harry Callaway, second president of the Bureau.

TELEVISION SET mock-up provided screen for viewing of 20 years of achievements of San Diego bureau by banquet guests. Dan Turner, director of bureau's sales training division, introduced showing

Dedication of the third 66,000-kw turbogenerator at San Diego Gas & Electric Co's Silver Gate station was part of the week's celebration. Starting-up ceremonies carried by the local television station included a telecast of San Diego mayor John D. Butler throwing a switch signalling the addition of the unit to the system. A later telecast showed the station operator putting the unit on the line in response to the mayor's signal. Emery D. Sherwin, company president, took part in the first telecast and later was interviewed on two radio programs conducted in connection with the dedication.

To acquaint the public with "Electrical Living Week" all available media were used. Posters and banners were given to 400 dealers for display throughout the county and announcements were carried by San Diego city and county newspapers. Secretary-manager Chamberlain presented the aims of the promotion and the fact of the Bureau's 20th birthday during a radio interview. Finally, 66 spot announcements were made on radio stations during the week.

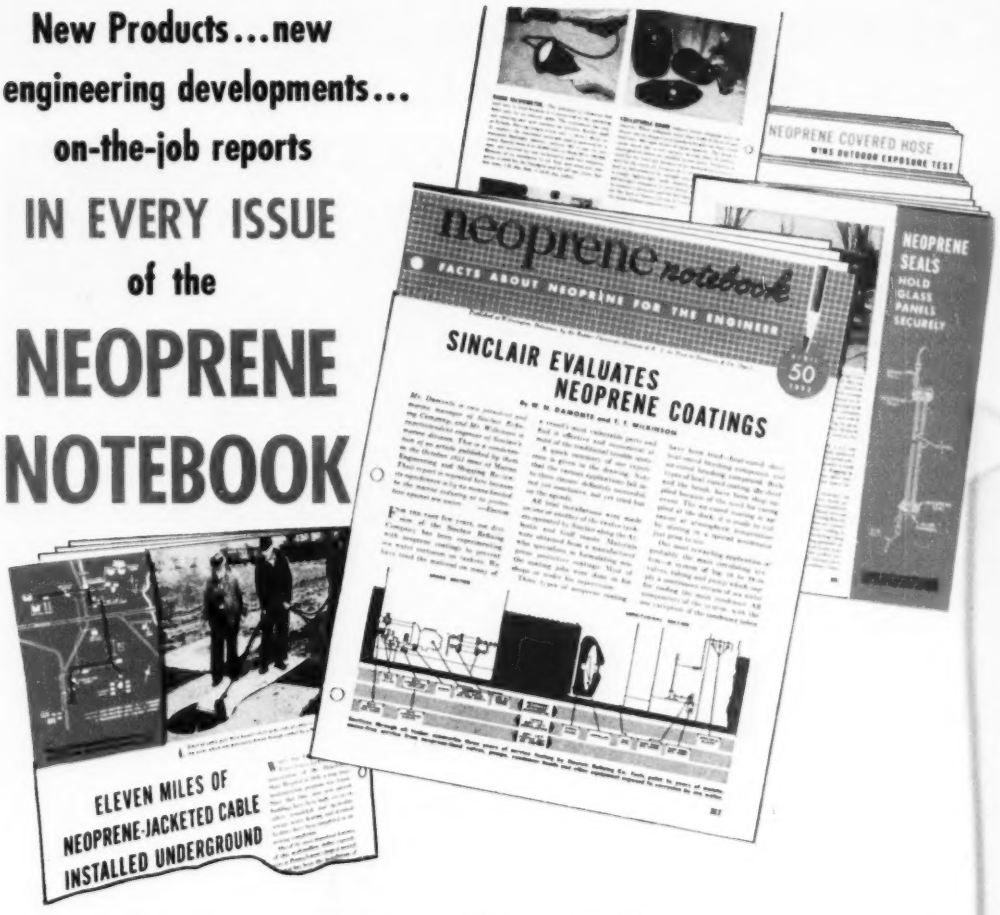


LARGE WINDOW STREAMERS identified the stores of 400 Bureau members participating in "Electrical Living Week"

New Products...new engineering developments... on-the-job reports

IN EVERY ISSUE of the

NEOPRENE NOTEBOOK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YOU'LL FIND profitable reading in every issue of the Neoprene Notebook.

Informative, up-to-the-minute articles report on neoprene's performance in products ranging from oil seals to conveyor belts . . . from motor mounts to work gloves. These engineering facts about neoprene are illustrated by specific data, pictures, and drawings.

Designers and design engineers find the Neoprene Notebook gives them ideas on how to use this versatile chemical rubber in designing a new product or improving an old one. Plant operating and maintenance engineers rely on the Notebook to bring them experiences of others who have solved production and maintenance problems with long-lasting neoprene products.

You can be sure to receive the Neoprene Notebook regularly by mailing this coupon today!

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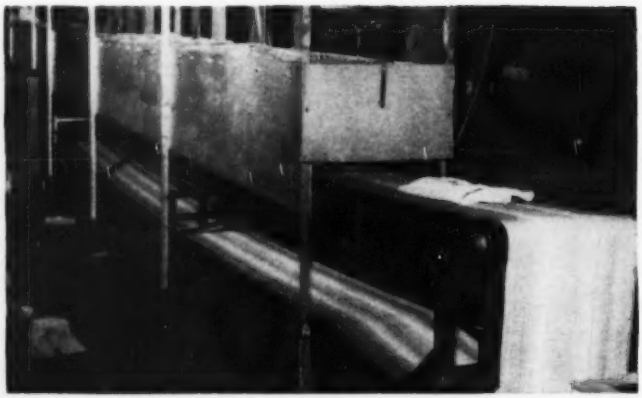
INDUSTRIAL APPLICATIONS

Infrared Oven Solves Drying Problem

P. J. BRITT, Industrial Representative, Pennsylvania Power & Light Co. Allentown, Pa.

A conveyor type infrared oven has solved a production drying problem at Allison Mfg. Co., Allentown, Pa., makers of polo shirts with silk screen printed designs and pictures. The oven has made possible the drying of up to 10,000 dozen polo shirts a week—a production rate not obtainable with the conventional air or steam heated ovens. The mechanized oven saves time and labor. Rejects due to smudging of partially dried designs have been considerably reduced.

The 50-ft conveyor type oven has 25-375-w infrared lamps at the entrance end of the tunnel and 105-250-w infrared lamps over the remaining part of the drying tunnel. After the shirts are printed, they are placed on the 24-in. wide conveyor belt, the speed of which is regulated to keep the shirts in the drying zone for approximately 3 minutes.



DRYING SHIRTS in conveyor type infrared oven saves time and labor—cuts rejects due to smudging of partially dried designs

The 35-kw load is wired in sections to provide flexibility in time and heat requirements for drying and baking the designs on various types of material. The shirts are boxed as they come out of the oven perfectly dry and with no danger of smudging. This company guarantees a No. 2 wash test on all their printed garments, which is made possible by the excellent drying and baking facilities afforded by the infrared oven.

Electric Heat Treating Improves Steel Products

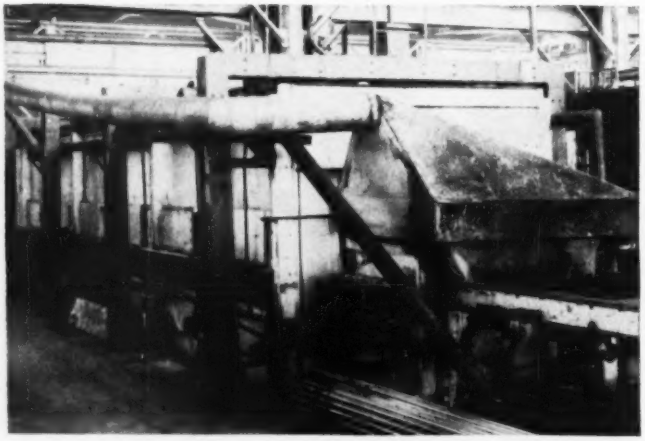
K. P. ALLEN, Industrial Power Salesman, Duquesne Light Co, Pittsburgh, Pa.

The change to electric heat treating from fuel heating has improved the quality of the steel products at the Columbia Steel and Shafting Co, Carnegie, Pa, processors of cold finished steel bars, shafts and cold drawn seamless tubing. Two furnaces were converted and two new electric furnaces were installed.

H. M. Brightman, assistant to the president and chief engineer of the company states:

"Employees and management are high in their praise of the electric furnaces. Electric heating is easily adapted to automatic control and provides a uniform heat throughout the furnaces. The changeover to electric furnaces has enabled us to improve our products and increase production.

"Also, working conditions were greatly improved. Fumes from the fuel-fired furnaces and excess heat in summer have been eliminated. The cleanliness and comfortable working conditions resulting from this change have materially improved employee efficiency. Furthermore, maintenance of the electric furnaces is practically negligible. This is a contrast to the substantial maintenance required on the fuel-heated furnaces."



ELECTRIC FURNACE has 1000-kw rating and four-zone control. Better working conditions, improved efficiency, reduced maintenance and better products have resulted

BASAL BARK SPRAYING IS EFFECTIVE ALL MONTHS OF THE YEAR!

Dow's proved brush killers control brush and trees in any season

When your spraying program includes dormant season basal bark treatment of brush and trees in addition to regular foliage spraying, you keep your crews busy and your application equipment in use more months each year.

Winter has been established as a good time for basal bark application. This important maintenance practice—spraying Esteron® 245 in oil on the basal 15 inches of brush stems or tree trunks—has proved its worth on many miles of roadside and right-of-way spraying.

Esteron 245 contains the powerful low volatility propylene glycol butyl ether esters of 2,4,5-T. Fuel oil, kerosene or diesel oil serves as the carrier—special oils are not necessary. Esteron Brush Killer, a mixture of low volatility propylene glycol butyl ether esters of 2,4-D and 2,4,5-T, is also effective for basal treatment and can be used with either hand or power equipment. Stump treatment with either of these products can be done in any season, and makes manual cutting effective as a brush control measure.

Dow sales and technical men are available for consultation and assistance. Call or write your nearest Dow sales office.

THE DOW CHEMICAL COMPANY

Agricultural Chemical Department

MIDLAND, MICHIGAN

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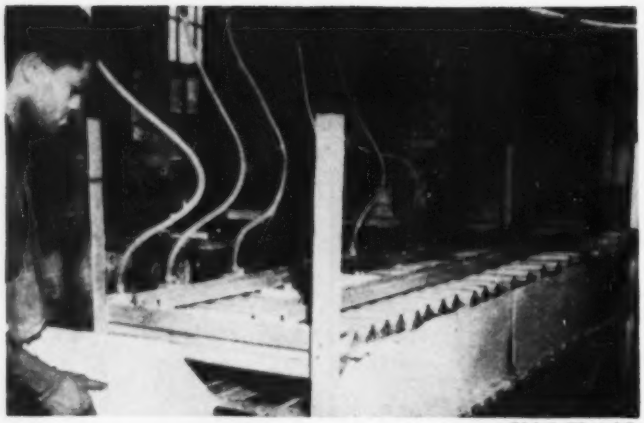
CHEMICALS

INDISPENSABLE TO INDUSTRY AND AGRICULTURE



Edwin L. Wiegand Co

DRYING PLASTER MOLDS with electric radiant infrared oven cuts rejects from 25 to 10% and turns out more even and precise molds compared with previous gas-fired method

Infrared Heat Cuts Rejects 15%

Precision plaster molds, used for aluminum castings, are being dried more evenly and precisely with an infrared oven according to W. R. Hale, vice president of Scientific Cast Products Corp, Cleveland, Ohio.

The effective production has been raised by reducing the number of rejected molds from 25 to 10%, with further reduction expected as handling is standardized.

Molds are now dried to the close tolerance of .001 in. per in. as compared with .002 variation under the previous gas-fired batch method. In the former batch oven the molds near the top, where hot air was forced in, dried faster than those at the bottom. The infrared radiant heat now dries all molds evenly and consistently.

A conveyor moves the molds through the oven at about 1½ in. per min maximum. The first 8 ft of the 12-ft oven are heated by 36 radiant heaters with a total capacity of 39.6 kw. The infrared is absorbed efficiently even by white materials with negligible reflection, and rapid heating results in short conveyor travel. One size 12 in. by 22 in. dries in about 1½ hr; the other, 12 in. by 22 in. by 2½ in. dries in 2 hr.

Resistance Heaters Provide Constant Temperature

Heating apertures of metal bushings with resistance heaters provides automatically controlled, constant temperature at Owens-Corning Fiberglas plant, Anderson, S. C. Manufacture of glass filaments for textile yarns requires uniform temperature at small apertures of metal alloy bushings from which molten glass flows to form the yarn for processing into textile products. Mixture of sand and other ingredients is melted and brought to initial temperature required for process by natural gas. A constant temperature of 2200 F is maintained by resistance heaters, automatically controlled to regulate flow of glass filaments at exceedingly high speeds. Total plant demand is 4,400 kw, including power for filament manufacturing, spinning, twisting, air conditioning, lighting and heating. Channing B. Brown, Power Engineer, Duke Power Co, Charlotte, N. C.

Heaters Reduce Hazards

Gutter heating with 3.2-kw lead covered heating cable in gutters and down spouts at Canton Stamping and Enameling Co, Canton, Ohio, keeps both clear of ice during worst winter weather. Monthly consumption is 2300 kwhr. Formerly, water overflow from gutters caused by frozen down spouts presented hazards from icy walks and falling icicles. G. W. Craiglow, Industrial Power Engineer, Ohio Power Co, Canton, Ohio.

INDUSTRIAL BRIEFS

Drying coils with infrared oven at the United Sound & Signal Co, Columbia, Pa., saves assembly line space and assures a moisture-free refrigeration system. Company manufactures grape juice dispensers for soda fountains. A bank of 8-375-w infrared lamps is installed in the assembly line to thoroughly dry out evaporated coils before they are connected and sealed to the refrigerating units. Oven requires only 4 ft in assembly line. W. F. DeLong, Industrial Representative, Pennsylvania Power & Light Co.

Heating pipes carrying liquid sucrose with lead covered heating cable, at Borden Dairy Co, Canton, Ohio, during cold weather lowers viscosity to summer temperature values and makes for easy pumping to upper floors. 720 ft of heating cable (3.2 kw) are wrapped around pipes between first floor storage tanks and third floor where sucrose is used in preparation of ice cream mixes. Monthly consumption is 2300 kwhr. G. W. Craiglow, Industrial Power Engineer, Ohio Power Co, Canton.

Finish drying work clothes in a 96-kw infrared oven at the Standard Overall Dry Cleaning Co, Norwood, Ohio, saves time, space, handling, and labor. Drying time is 1¼ min per garment, compared with 15 to 20 min with the formerly-used steam-heated dryer. Pressed clothes are hung on conveyor and passed through infrared oven having 192-500-w lamps and occupying only 1/5 floor space required by former steam heated dry house. F. W. Conover, Power Engineer, Cincinnati Gas & Electric Co.

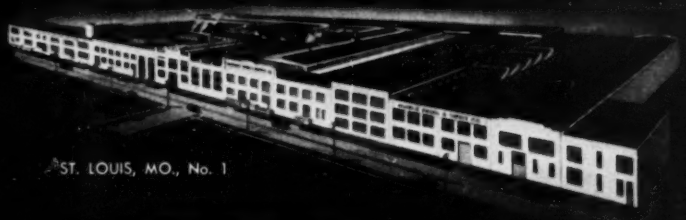
High pressure steam is obtained from a low pressure steam source by three motor-driven steam compressors at Saint Benedict Moor Mission hospital, Milwaukee, Wisconsin—replacing an inadequate gas-fired steam boiler which gave repeated trouble. Two 40-hp and one 15-hp compressors are used. When high pressure is required, low pressure steam valve is opened and compressor is started. The high pressure, high temperature steam is needed for laundry and kitchen equipment. Carl H. Swenson, Industrial Power Engineer, Wisconsin Electric Power Co.

Users of Piping

whether a simple bend welded assembly or

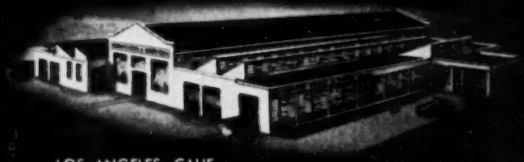
complete piping systems for power plant or process

get Multiple Advantages from MIDWEST Multiple Plants

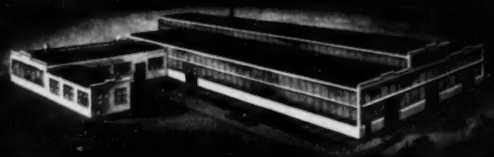


ST. LOUIS, MO., No. 1

ST. LOUIS, MO., No. 2



LOS ANGELES, CALIF.



PASSAIC, N. J.

BOSTON, MASS.

Strategically located multiple plants and large scale operations have made it economically practicable for Midwest to develop much special pipe fabricating machinery and to conduct piping research that would be impossible under other circumstances. Multiple plants create a friendly rivalry between the organizations of these plants that advances the art of piping fabrication more rapidly than would otherwise occur. All these activities are reflected in better fabricated piping . . . in greater piping value per dollar. • Multiple plants help make Midwest the preferred source for prefabricated piping. 4909

MIDWEST

PIPING & SUPPLY COMPANY, INC.

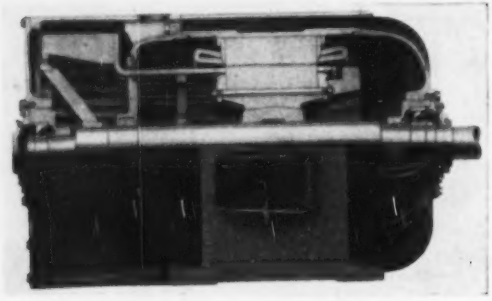
Main Office: 1450 South Second Street, St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and Boston

Sales Offices: New York 7—30 Church St.
Los Angeles 23—520 Anderson St.
Boston 27—436 First St.
Chicago 3—79 West Monroe St.
Tulsa 3—324 Wright Bldg.
Houston 5—1216 Capitol Ave.

PIPING FABRICATORS AND CONTRACTORS FOR MORE THAN 50 YEARS

NEW EQUIPMENT

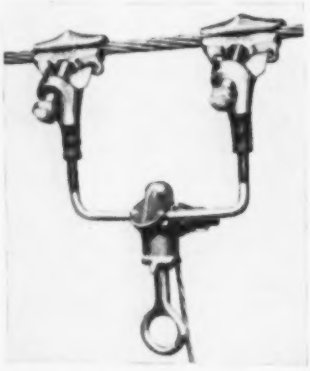


High-Slip Motor

Totally enclosed, fan-cooled high-slip induction motors designed for acceleration of high inertia loads. Type KRX, the motor is said to be 30% smaller, 40% lighter than comparable motors, as a result of the extended-bar design heat dissipation. Rotor bars extend to form radial blade fan, which also provides the high rotor resistance.

Available 30-150 hp, 900 and 1,200 rpm, 5-8 and 8-13% slip, 220/440/550v.

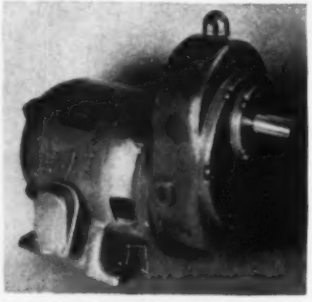
General Electric Co, Schenectady 5, N. Y.



Tap-Off Stirrup

For use on hot line installations. The unit transfers arcing while making and breaking load currents from the run wire to the stirrup. Double clamp gives more contact area on the run wire. One-piece construction; can be installed with hot line tools. Designed primarily for aluminum conductors and copper taps, but also made in all-bronze and copper. Available for 6 to 2 ACSR range and 2 to 4/0 ACSR range.

Fargo Mfg Co, Inc, Poughkeepsie, N. Y.



Reduction Gearmotors

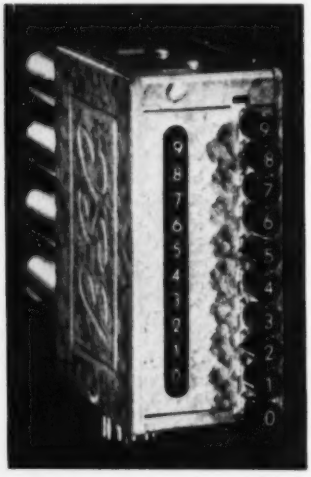
Using standard NEMA frame size motors to support the self-contained over-hung gearhead reduction unit. Six sizes are available in standard motor ratings 1-30 hp, with standard gear ratios ranging 2.24:1 to 4.17:1.

Claimed advantage is smaller size, higher efficiency of high speed motors for given output torque. Designed primarily for use with ac squirrel cage motors of open, splash proof, and totally enclosed construction, they are adaptable to wound rotor and dc motors. Manufactured according to American Gear Mfr's recommendations.

Westinghouse Electric Corp, Nuttall Plant, Pittsburgh, Pa.

Decimal Counting Unit

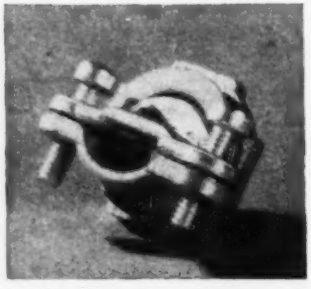
A direct reading electronic counter capable of producing output information at speeds to 40,000 counts per second, the Model 730 is preset and is capable of resolving pulse pairs separated by as little as five microsec. Each counter is a plug-in unit and units are



interchangeable. With additional circuitry the output pulse can be used to electronically reset the unit.

The power requirements are: filament 6.3v, 2.1 amp; plates 300v 15 ma,-150v 2 ma.

Berkeley Scientific Division, Beckman Instructions Inc, Richmond, Calif.

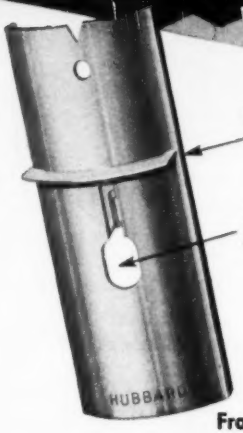


Cable Clamp

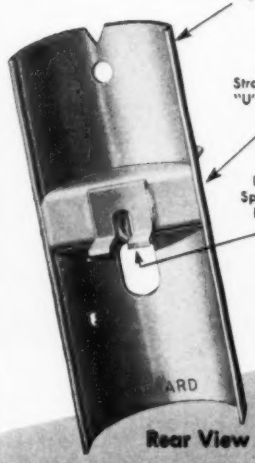
Movable portion is straight for T type as well as regular type sheathed cable. Die-cast.

Neer Manufacturing Co Inc, Columbus, Ohio.

THE *New* HUB-PLATE



Front View



Rear View

- **LIGHTER WEIGHT**
- **EASIER HANDLING**
- **LOWER FIRST COST**
- **LONG-LIFE STURDINESS**

HUBBARD Engineers have designed a new Anchor which, because of its built-in strength combined with light-weight economy, has already met with enthusiastic acceptance.

The HUB-PLATE is formed from 3/16-inch steel. Turned edges run the length of the plate, and extra rigidity is provided by the ¼-inch welded fin and liner.

The punching and slotting are designed to permit easy slipping of the plate over the spearhead of the anchor rod, regardless of the angle from which the driven rod enters the hole. When the rod is pulled tight the plate is always firmly entrenched against undisturbed soil, and the fin prevents the plate from "riding" upward.

The "U" shaped liner fits the curve of the concave side of the anchor, to which it is welded. To the flat side of the liner, in turn, a retaining plate is welded, with curved lugs which prevent the spear-pointed anchor from disengaging.

The HUB-PLATE is Hubbard double-dip hot galvanized for enduring protection against corrosion. It is furnished in two sizes: 6 by 15-inches and 8 by 20-inches.

Installation Diagram for HUB-PLATE Anchors.

Cross Sectional View Showing Method of Attaching Rods to Plate Anchors. Note the Flexibility permitted in Positioning of the Anchor Rod.

HUBBARD AND COMPANY

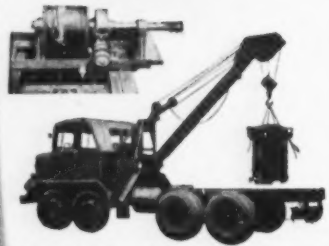
ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

Utilities Have Specified
SILENT HOIST Equipment
• Since 1918 •

KRANE KAR Swing-Boom Mobile Crane: for materials handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 5 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.



WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING-BOOM CRANES: Truck: Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.

TOWERS: 2 or 3 section type and Pantograph types, with plain, revolving or rocking platforms.

TRIPOD POLE DERRICKS for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic side legs; removable cast steel fittings.

USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

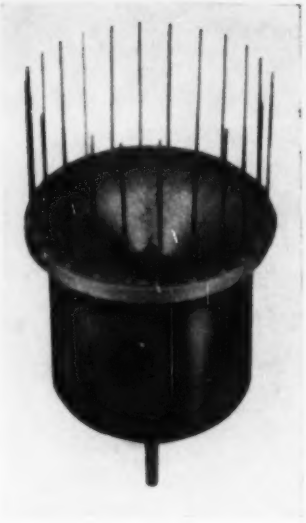
WRITE FOR CATALOGS:
No. 79—KRANE KAR *No. 70—Truck Equipment*

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER
2½, 5 AND 10 TON CAPACITIES
KRANE KAR
TRADE MARK REGISTERED
SILENT HOIST & CRANE CO.
862 63rd ST., BROOKLYN 20, NEW YORK

Weather Sensing

Designed for deicing microwave antennas, towers and pole lines, etc. The unit, 7¼ in. in dia, detects precipitation when ambient temperature drops below 37 F. (normal borderline temperature for snow). An integral heater melts the snow and ice collected in the bowl. Heater remains on until icing hazard is past.

Motorola Communications & Electronics Division, Chicago 51, Ill.

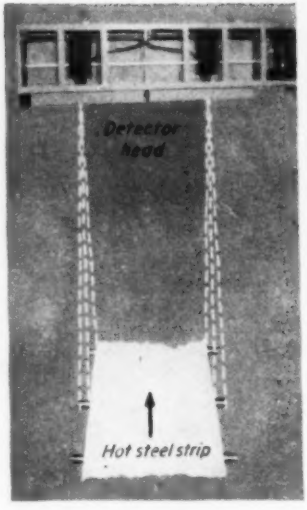


Width Gage

For continuously and automatically measuring the width of a hot steel strip, without contact, to an accuracy of ±⅛ in. Two phototube scanners in the sealed detector head are mounted 15 ft above the hot strip; they convert light radiated from the strip into two pulsating electrical square waves, which are amplified, added and balanced against a standard voltage to produce a signal proportional to width deviation.

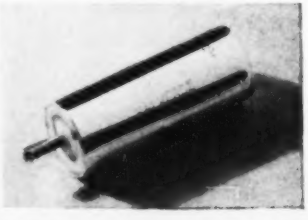
The operator's cabinet contains a three-diget counter which indicates the width for which gage is set, a deviation indicator, and controls for setting and calibrating. Strip widths 10 to 96 in. can be measured at 1350 to 2050 F. Power required is 550 va, 220/440/550 v 3-phase 60 cps.

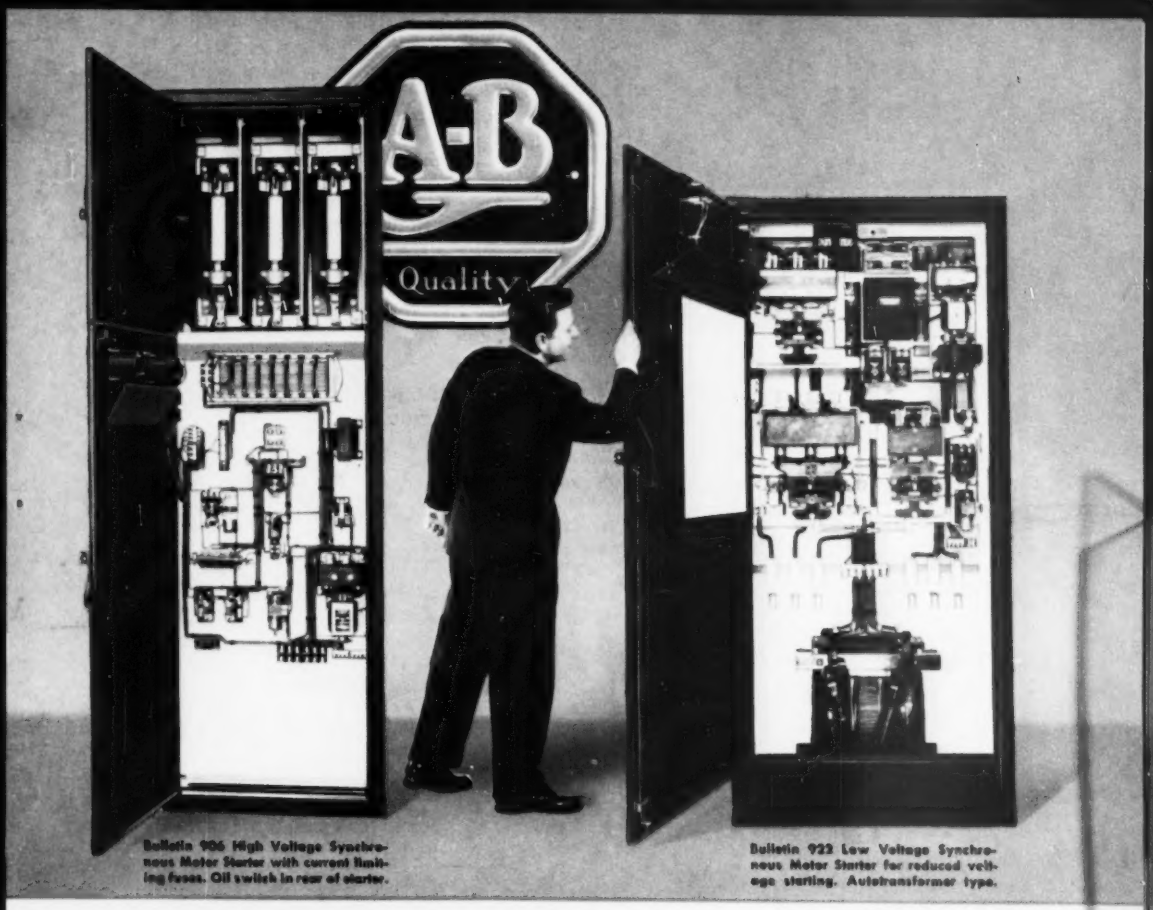
General Electric Co, Schenectady, N. Y.



Miniature Thermostat

For setting to 500F, is hermetically sealed, measures ⅜-in. dia, 15/16-in. long. Bimetal is friction couple snap action, and both the temperature and differential are adjustable. The thermostat can be used without the capsule for on-the-job adjustment.





Bulletin 906 High Voltage Synchronous Motor Starter with current limiting fuses. Oil switch in rear of starter.

Bulletin 922 Low Voltage Synchronous Motor Starter for reduced voltage starting. Autotransformer type.

STARTERS FOR BIG MOTORS

Bulletin Number	Type of Motor	Operation	Maximum Horsepower 208-220v	440-550v	2000-2500v	2501-4600v
646	Sq. Cage	Manual	125	250	—	—
726	" "	Automatic	—	—	700	700
740	" "	"	300	600	—	—
741	" "	"	300	600	—	—
742	" "	"	300	600	—	—
746	" "	"	300	600	—	—
747	" "	"	—	—	700	70
904	Synchr.	Manual	125	250	—	—
906	"	Automatic	350*	700*	900*	90
914	"	"	250*	250*	—	
922	"	"	350*	700*	900*	90

(*) At 100% power factor

● The motor starters, shown above, are examples of the many big units in the Allen-Bradley line.

Various types of manual or automatic starters for synchronous motors are available . . . up to 900 hp., 220 to 4600 volts.

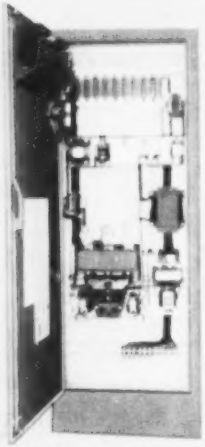
High voltage squirrel cage automatic motor starters are listed up to 700 hp., 2000 to 4600 volts. Relays and contactors are time-tested A-B designs, fully protected when specified, by current limiting fuses.

The A-B Handy Catalog is a convenient manual on motor controls . . . large or small. Write for it, today!

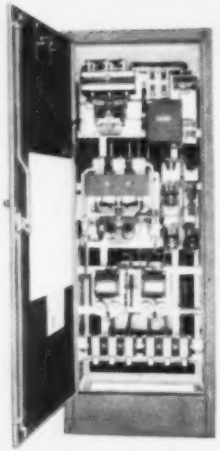
Allen-Bradley Co., 1316 S. Second St.,
Milwaukee 4, Wis.

8-52—MR

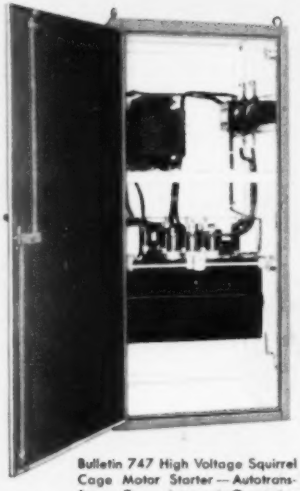
ALLEN-BRADLEY
QUALITY
MOTOR CONTROL



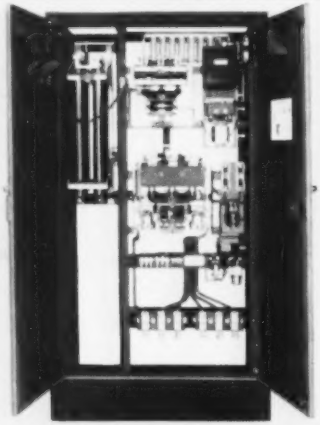
Bulletin 906 Low Voltage Synchronous Motor Starter—Full Voltage Type—Automatic Operation



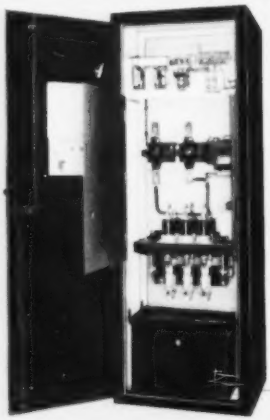
Bulletin 742 Low Voltage Squirrel Cage Motor Starter—Stepless Resistance Type—Automatic



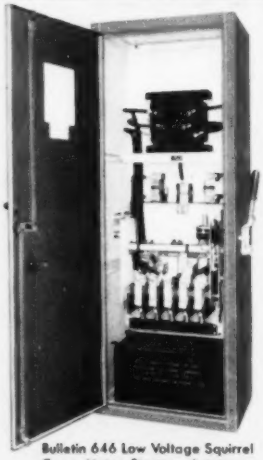
Bulletin 747 High Voltage Squirrel Cage Motor Starter—Autotransformer Type—Automatic Operation



Bulletin 914 Low Voltage Synchronous Motor Starter—Resistance Type—Automatic Operation



Bulletin 726 High Voltage Squirrel Cage Motor Starter—Full Voltage Type—Automatic Operation



Bulletin 646 Low Voltage Squirrel Cage Motor Starter—Autotransformer Type—Manual Operation

Starters for Large High and Low Voltage Motors

The high quality of design and construction, which has made the Allen-Bradley line a leader among motor starters, is built into Allen-Bradley starters for big motors, too.

These big starters can be supplied with all standard accessories, such as contactors for controlling auxiliary equipment, meters and instruments, current limiting fuses, etc. At maximum rating, these starters have an interrupting capacity of 10 times motor full load current.

Standard features of A-B synchronous starters include polarized field frequency relay, automatic resynchronization, thermal overload relays, out-of-step relay, and undervoltage protection. Reduced voltage starting is available either with resistor or autotransformer control.

Standard features of the big A-B squirrel cage motor starters include overload relays. Current limiting fuses are recommended for all high voltage starters.

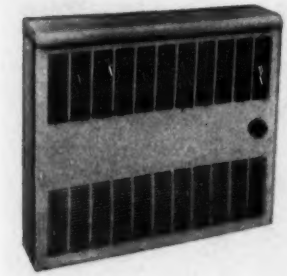
ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

A-B Quality

Allen-Bradley Company
1316 S. Second Street
Milwaukee 4, Wis.

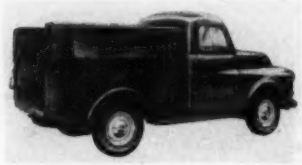
B-52—MR

Permanent temperature setting is claimed, setting tolerance can be ± 2C, differential less than 3C.
Valverde Laboratories, New York 12, N. Y.



Convection Heater

With built-in thermostat, grey metal cabinets for flush or recessed wall mounting. "Fin" type heating element carries five yr guarantee. BTU ratings 2,400 to 9,600, 5 sizes 700 to 2,800w.
Paley Manufacturing Co. Brooklyn 16, N. Y.



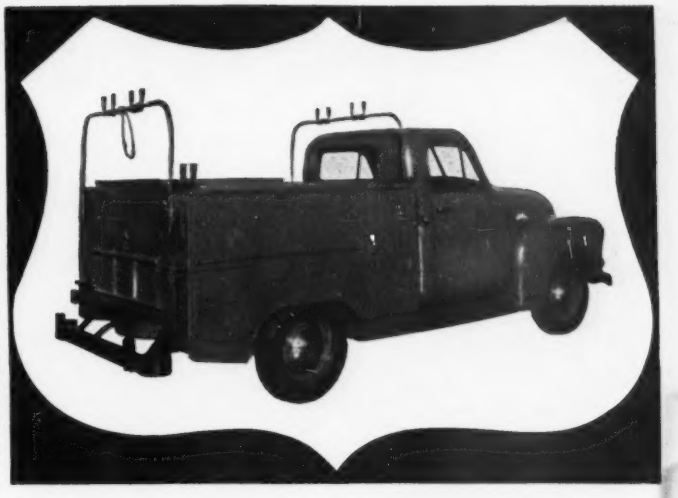
Side Boxes

For pick-up or express body, all steel boxes are available 75 in. long for ½-ton and 91 in. long for ¾ and 1-ton pick-up bodies. Boxes are mounted flush with the inside walls, giving additional height in carrying area. Doors when open act as workbench area. Attached by braces and brackets supplied.
Morrison Steel Products Inc, Buffalo 7, N. Y.

High-Voltage Rectifier Tubes

Type 6102 for application with peak inverse voltages to 40kv, maximum average current 150 ma, peak current

(*Continued on page* 148)



it's new... HIGHWAY GS-75

GENERAL SERVICE BODY

STURDY • FLEXIBLE • ALL-PURPOSE

At last! Here is a basic, general service body to which you can add your own selection from a wide variety of options to actually "build" a unit to meet your specific needs. At the same time you control the cost to fit your purse. With the Highway GS-75 you are not required to take a manufacturer's "pet ideas" as a permanent part of your body.

This sturdy all-steel body is equipped with heavy, double-panel doors opening on spacious side-box compartments. Two different side-box shelf arrangements are available as options. Locking-type, recessed handles on the doors control strong one key bar-locks. The doors are weather-sealed with sponge rubber, retained by metal strips. A popular option is the steel roof that slides forward, folds down and locks to the tailgate, protecting any materials stored in the big interior bed compartment.

Sidebox Arrangement "A"

Sidebox Arrangement "B"

Body is 75" length, 74" width. Mounts on most ½ ton chassis, "CA" dimensions 39" to 41".

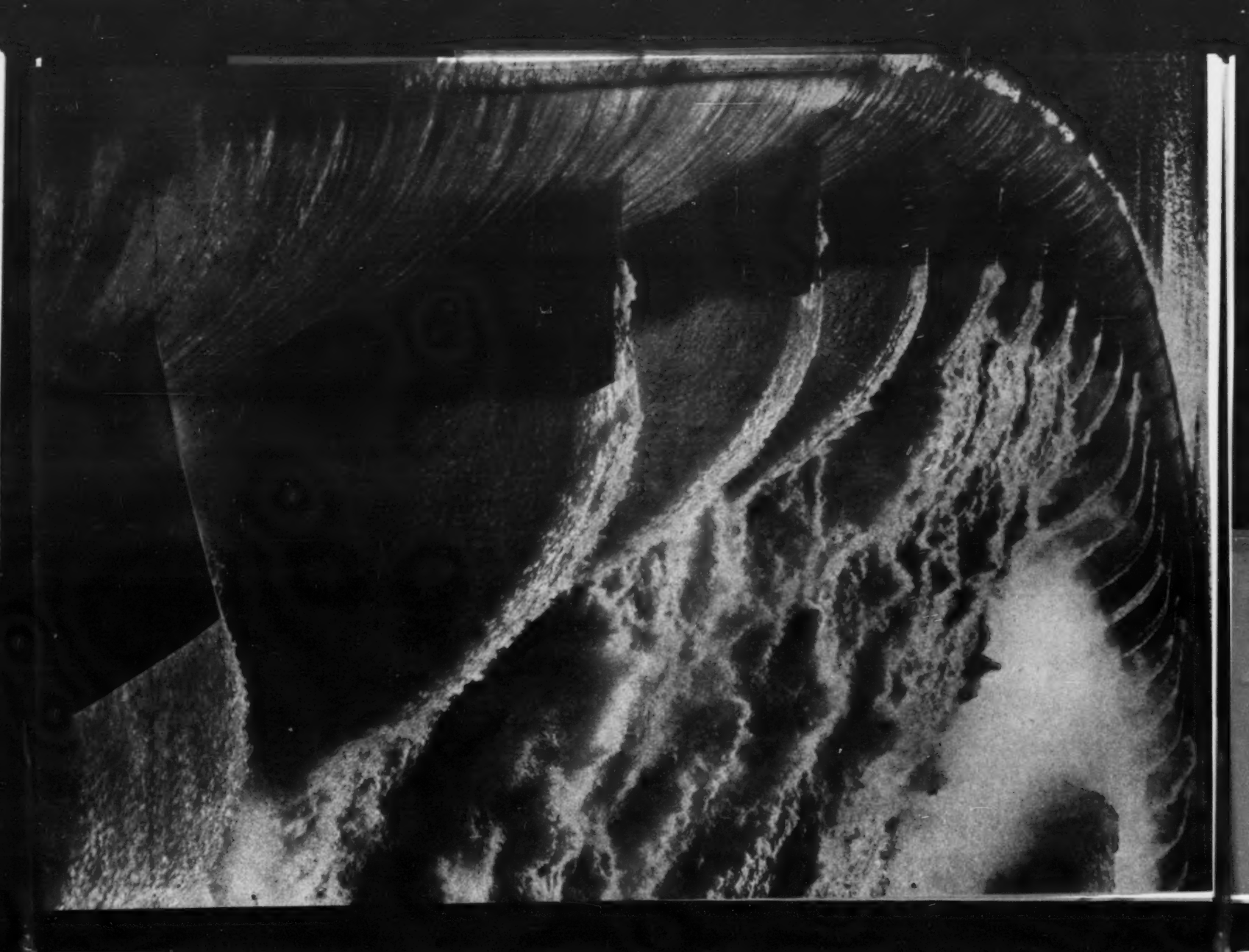
Send today for full information on this new Highway GS-75 body and other Highway public utility equipment. Or, call or visit the friendly Highway Distributor or Factory Branch nearest you.

HIGHWAY TRAILER COMPANY

Headquarters: Edgerton, Wisconsin

PLANTS AT EDGERTON, WISCONSIN—STOUGHTON, WISCONSIN

The nation's largest Manufacturers of Utility Truck Bodies • Earth Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-offs • Service Accessories



cochrane
water conditioning

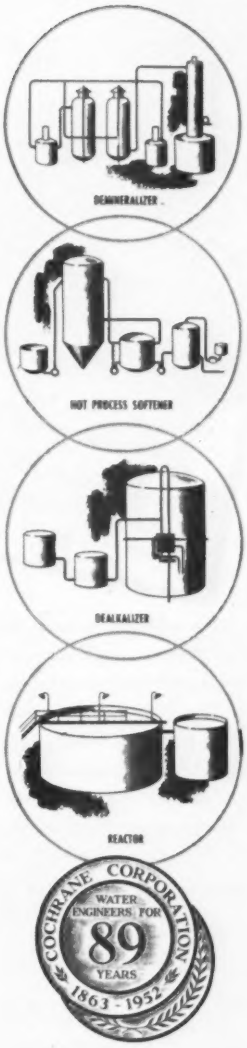
STARTS WHERE NATURE STOPS

Nature's purest water will not meet the stringent requirements of modern industrial processing. The presence of minerals, salts or gases makes it unsuitable or uneconomical for direct use. Profitable elimination of corrosive or process retarding elements requires specialized experience such as furnished by Cochrane Water Engineers.

Engineering wisdom dictates that it is not so important to know all the answers as to know where to get them. The problems of Ion Exchange, Demineralization, Deaeration, Dealkalization, and others are complex; and there is only one *best* solution to any set of conditions. That's why leading engineers and consultants call on Cochrane for the answers.

To any water conditioning problem Cochrane contributes 89 years of accumulated "know-how". Whether your requirements are for process water or boiler feedwater, Cochrane can show you how to obtain them—economically and efficiently. And since Cochrane manufactures all types of water conditioning equipment, you are assured unbiased recommendations.

When you have a water conditioning problem call on Cochrane. Your requirements will be thoroughly surveyed by a Cochrane Water Engineer . . . then you'll know you're right. To give you prompt consultation and service, Cochrane Water Engineers are strategically located in 29 cities throughout the United States. Write today for the address of our office nearest you.



HOT PROCESS SOFTENERS • HOT and COLD ZEOLITE SOFTENERS • DEAERATORS and OPEN HEATERS • DEMINERALIZERS • DEALKALIZERS • DEGASIFIERS • REACTORS and CLARIFIERS • CONTINUOUS BLOWOFF SYSTEMS • STEAM SPECIALITIES • CONDENSATE RETURN SYSTEMS

cochrane
corp. 3146 N. 17TH STREET, PHILADELPHIA 32, PA.

In Canada: Canadian General Electric Co., Ltd., Toronto
In Mexico: Babcock & Wilcox de Mexico, S.A., Mexico City
In Europe: Recuperation Thermique & Epuration, Paris

COCHRANE CORPORATION — WATER ENGINEERS FOR 89 YEARS — 1863 - 1952

DRAFT FANS GO on GREEN

- Two Induced Draft Fans, each 198,000 cfm; 300°F stack gas at 15" static pressure.
- And special features include: radial tip blades, erosion-resistant wheels, control type inlet dampers, air-cooled bearing for outdoor service.

This installation, located in the South, adds to the mounting evidence that Green Draft Fans are very much in the boiler plant picture, both utility and industrial... evidence that they are high on the specification lists of leading consulting engineering firms and on the owners' lists of acceptable equipment.

There are numerous things about Green Induced and Forced Draft Fans that make them desirable auxiliary equipment for any boiler. We suggest that you have the basic facts at hand when you start planning for your fans. Send for our Bulletin 168 and in writing, tell us about your requirements.

THE GREEN Fuel Economizer COMPANY INC.

- Economizers
- Fans
- Air Heaters
- Cinder Traps
- Aerodyne Dust Collectors

BEACON 3, NEW YORK

Photo above shows the Green ID Fans being installed in the Chesterfield Power Station Extension of the Virginia Electric and Power Co., at Drewrys Bluff, Virginia.

900 ma; for oil-immersed operation, 2 15/16-in. long and 2 13/16 in. dia,

Type 6103 for applications with peak inverse voltages to 20 kv, maximum average current 150 ma, peak current 900 ma. Provided with integral radiator for forced air cooling. 2 15/16-in. long and 2 12/16 in. dia, weighs 8½ oz.

Westinghouse Electronics Tube Division, Elmira, N. Y.

Unit Heaters

For floor, wall or ceiling mounting, as basic or supplemental heat source. The 20-kw model has a heavy-gauge sheet metal case, wrinkle finished, strip heater elements sheathed in steel, a fractional horsepower motor blower, and adjustable aluminum louvers. A thermal cutout guards against overheating. Overall dimensions 17x21x21 in., weight 79 lb. Operates on 230 or 460v single or three phase.

Edwin L. Wiegand Co, Pittsburgh 8, Pa.

DC Power Supply

Selenium rectifier, bench or wall mounting, 300-w or 500-w unit, operating from 115v 60 cycles, furnishes 90 to 135v filtered dc output. Output voltage can be varied by 5-position tap switch. Output ripple claimed less than 5% at pull load. Rated for continuous duty at full load, over-load protection is built-

Another Westinghouse Relay Development

New CO Relay

gives greater accuracy!

The Type CO Overcurrent Relay is available in Flexitest or standard rectangular projection case.

This latest advance in design gives a degree of accuracy heretofore unattainable in an induction disc relay. The reason—a new basic relay development—the "E" element.

The "E" element has four separate and independent adjustments to make it meet existing time curves accurately—very accurately! This high degree of accuracy permits faster protection for your lines and equipment.

For further assurance of accuracy the new CO Relay offers low-wave form and low-temperature error . . . micrometer adjustment of the permanent magnet . . . constant "pick-up" at all lever settings.

Ask your Westinghouse representative to show you the new CO Relay—he'll be glad to go over it feature by feature with you—or request a demonstration by writing to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40404

YOU CAN BE SURE...IF IT'S
Westinghouse
RELAYS

Take the High Cost Out of High Work!

with the

Industrial Monkey

This is the equipment that is greatly reducing high work cost, stepping up efficiency and saving manpower for many utility firms.

The Monkey — a hydraulically operated, telescoping boom with self-leveling cage — has been *job-tested* and experience-proved to become standard equipment for many high work jobs.

The Industrial Monkey speeds up work four to five times and rapidly pays for itself in reduced operating costs.

Here's Why the Industrial Monkey PAYS OFF!

- Foot-controlled — both hands free for work.
- Works from horizontal to vertical within 270° arc.
- 40 ft. ground-to-platform.
- Worker protected against 24,000 volts.
- Safe — dual controls.

Cut the high cost of high work!

. . . Put Industrial Monkey to work in your operation. For complete information, call, wire or write today.

THE DONWILL COMPANY

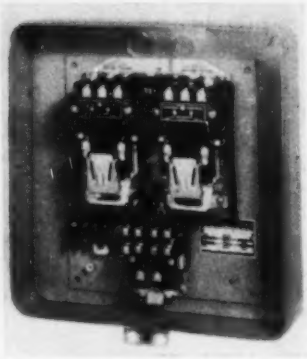
835 S. E. MAIN STREET, PORTLAND 14, OREGON

MOBILIFT CORPORATION • 2317 W. 18th, CHICAGO

790 PATTERSON AVE., E. RUTHERFORD, N. J. • 2724 TAYLOR ST., DALLAS

1113 SPRING ST. N. W., ATLANTA • 2730 SAN PABLO AVE., BERKELEY

in. 300-w model weighs 6 lb, measures 5x6x7; 500-w model weighs 8 lb, measures 6x7x8.
Rapid Electric Co. New York 61, N. Y.



Throwover Panel

An automatic control device that transfers electric circuits to emergency power when the normal source fails. Throwovers have been made legally mandatory for many public buildings.

Besides transferring circuits from a failed normal to an emergency source and back again on resumption of service, the contactors also activate standby power equipment as needed. The panel can be equipped with a voltage-sensitive relay and/or a time-delay relay.
General Electric Co, Schenectady 5, N. Y.

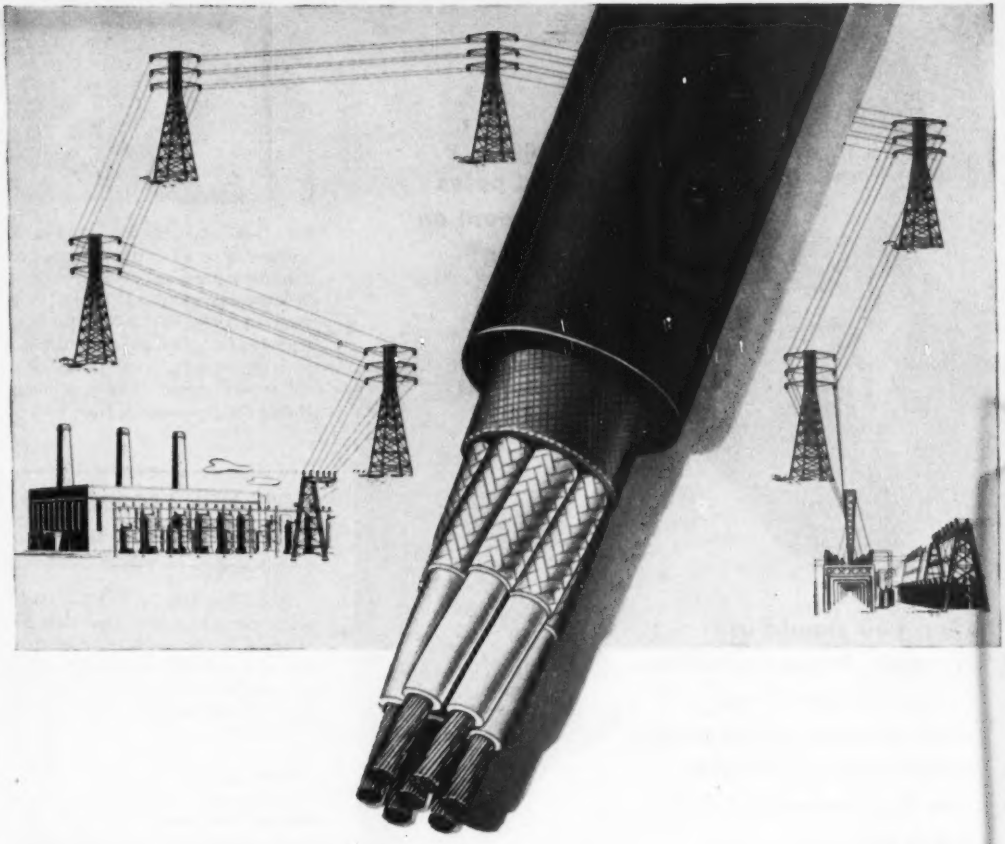
Paint Spraying Equipment

Designed to charge the paint electrically within the spray apparatus itself. Paint is said to be highly ionized so it differentiates between painted and unpainted surfaces. Increased efficiency claimed to quarter necessary man-hours and save over 60% on paint.

Unit includes a power supply and control available in 80-140 kvp range, from all standard voltage inputs.
Scientific Electric, Garfield, N. J.

Xerograph

That reduces or enlarges engineering drawings, charts, etc., directly on



NOT ONE FAILURE in over 20 years

Laytex®-Neoprene Supervisory Control Cables

There has never been a reported failure of Laytex-insulated control cable in its 20 years of manufacture. The insulation resistance of these cables actually improves in wet locations! The small diameter of Laytex makes unnecessary the enlargement of cable ducts where signal service is expanding. The neoprene jacket provides exceptional resistance to abrasion and other abuse, and is highly resistant to the action of oil, flame, and sunlight. The cables are light in weight, easy to install.

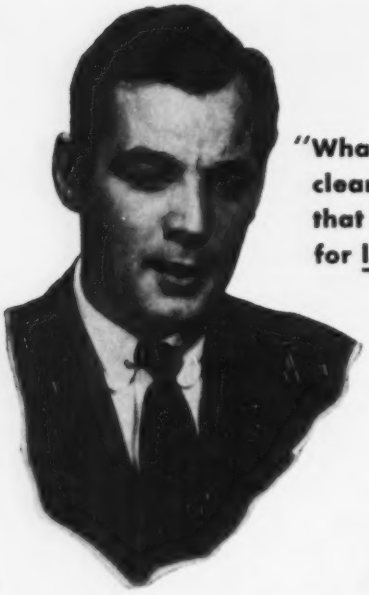
There is U. S. Control Wiring for every type of control, supervisory or metering problem. They are unexcelled in electrical qualities; dielectric strength and tensile strength are extremely high; low water absorption, high aging and moisture-resistant qualities. For more information write to address below.

PRODUCTS OF

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE AND CABLE DEPARTMENT • 1230 AVENUE OF THE AMERICAS, NEW YORK 20, NEW YORK



"What we want are clean treated poles that we can count on for long service!"

"Then you should use creosote. Proper pressure treatment combined with creosote of the proper specifications will give you dry, complaint-free poles that are completely protected against decay."

Remember . . . creosote is the only preservative that has kept wood sound and serviceable under severe conditions for more than 30 years.

KOPPERS COMPANY, INC., Pittsburgh 19, Pa. • Tar Products Division
DISTRICT OFFICES: Boston, Chicago, Los Angeles, New York, Pittsburgh, and Woodward, Ala.

All Standard Specifications

KOPPERS Creosote

The Performance-Proved Wood Preservative

You can count on Koppers for Creosote!

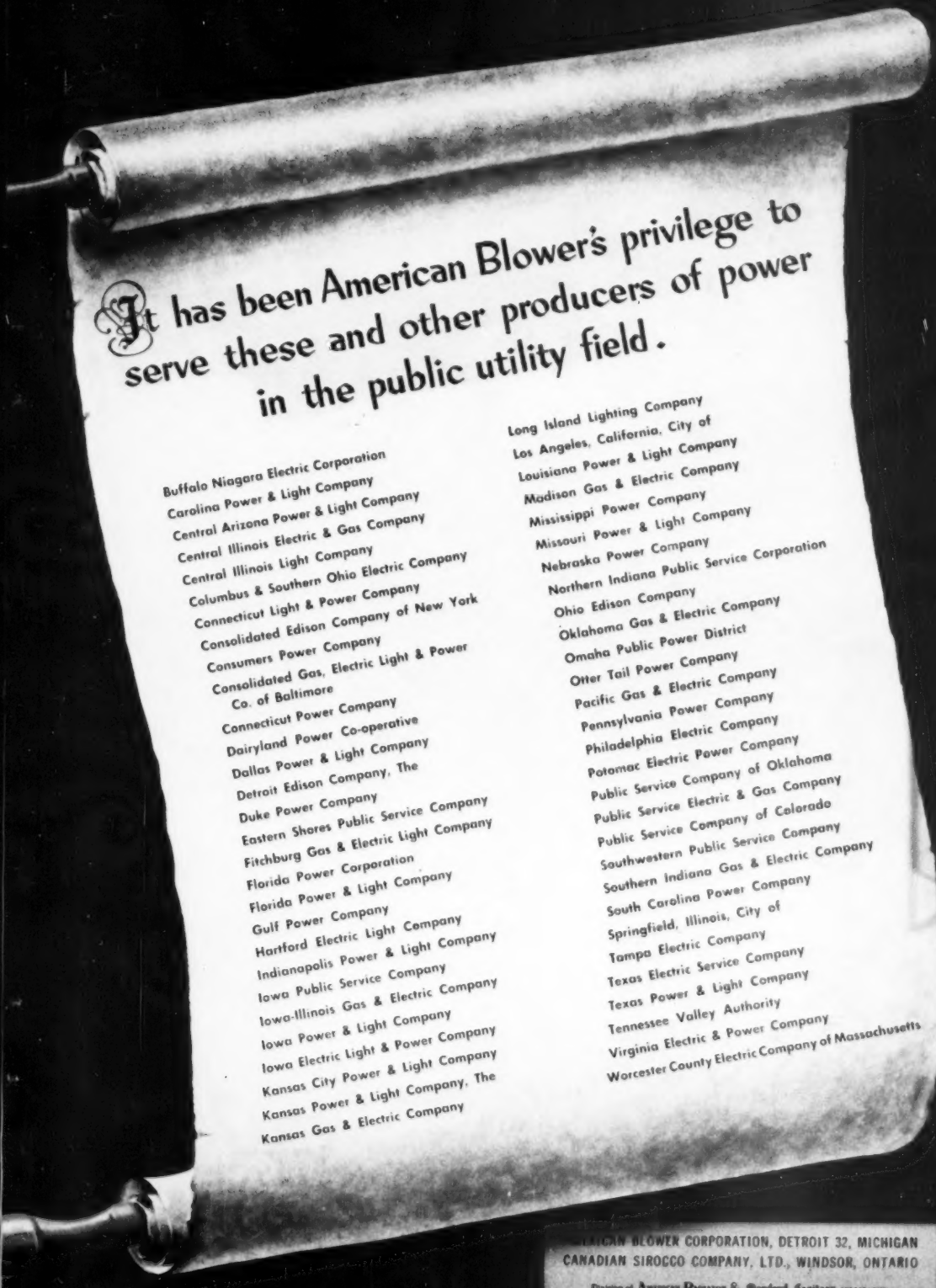
8½x13-in. plate. Image on plate is transferred to offset paper master or translucent paper and made permanent by a few seconds fusing. Model No. 3 camera permits 50 to 150% size copy reproduction. Complete unit consists of camera, copier, fuser; process does not require special operator training. **Haloid Co, Rochester 3, New York**

MORE NEW PRODUCTS
about which you should know

Thread-Ezy Mfg Co, Lansing, Mich, has a portable power **pipe threader** weighing 26 lb, for ¼ to 4-in pipe. One man operated, ½ hp 110v dc or ac reversible motor which removes unit from finished threads. Working area 12 in.

General Electric Co, Bridgeport 2, Conn has size 14 to 10 AWG BX **armored cable** with an inorganic glass braid, said to be rot and flame proof, allow smaller diameter cable. New cable fits standard fittings . . . Enco Mfg Co, 4520 W. Fullerton Ave, Chicago 39, Ill, has a portable **demagnetizer,** No 500, said to demagnetize tools, pieces, etc by sliding over the surface. Mounted on a plastic base 1¼ x 4 x 1⅝ in, with an extension cord, device plugs into 110v ac, operates by momentary action switch.

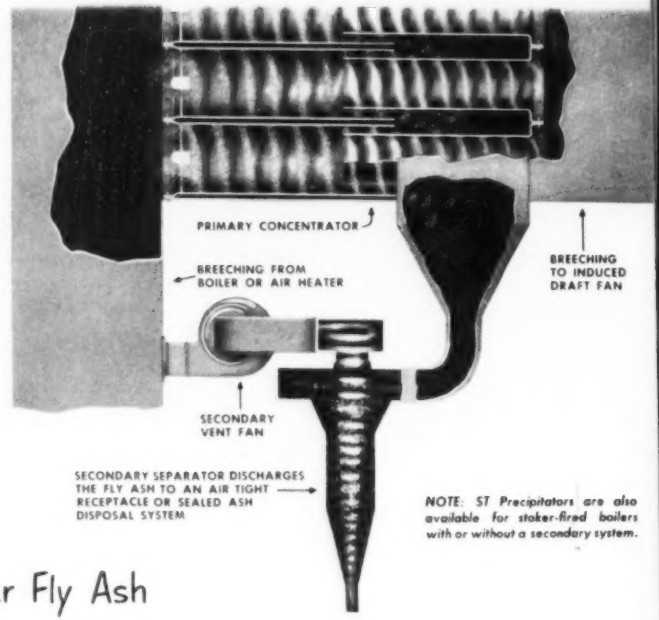
Aget-Detroit Co, Ann Arbor, Mich, has Model 30ND50 **dust collector** for outside exhaust of cleaned air at rated capacity of 3,630 cfm at 6-in static suction on an 8-in dia pipe. Dust storage capacity is 12 cu ft. The 5-hp motor operates on 220/440v 3 phase 60 cps . . . Babcock & Wilcox Co, New York 17, N Y, has an **oil additive** to remove deposits on boiler tubes from residual fuel oil. The additive is mixed, batch-wise, in agitated heated fuel oil. It has been tested in the Florida Power Corp Inglis and Higgins Station.


It has been American Blower's privilege to serve these and other producers of power in the public utility field.
Buffalo Niagara Electric Corporation
Carolina Power & Light Company
Central Arizona Power & Light Company
Central Illinois Electric & Gas Company
Central Illinois Light Company
Columbus & Southern Ohio Electric Company
Connecticut Light & Power Company
Consolidated Edison Company of New York
Consumers Power Company
Consolidated Gas, Electric Light & Power Co. of Baltimore
Connecticut Power Company
Dairyland Power Co-operative
Dallas Power & Light Company
Detroit Edison Company, The
Duke Power Company
Eastern Shores Public Service Company
Fitchburg Gas & Electric Light Company
Florida Power Corporation
Florida Power & Light Company
Gulf Power Company
Hartford Electric Light Company
Indianapolis Power & Light Company
Iowa Public Service Company
Iowa-Illinois Gas & Electric Company
Iowa Power & Light Company
Iowa Electric Light & Power Company
Kansas City Power & Light Company
Kansas Power & Light Company, The
Kansas Gas & Electric Company
Long Island Lighting Company
Los Angeles, California, City of
Louisiana Power & Light Company
Madison Gas & Electric Company
Mississippi Power Company
Missouri Power & Light Company
Nebraska Power Company
Northern Indiana Public Service Corporation
Ohio Edison Company
Oklahoma Gas & Electric Company
Omaha Public Power District
Otter Tail Power Company
Pacific Gas & Electric Company
Pennsylvania Power Company
Philadelphia Electric Company
Potomac Electric Power Company
Public Service Company of Oklahoma
Public Service Electric & Gas Company
Public Service Company of Colorado
Southwestern Public Service Company
Southern Indiana Gas & Electric Company
South Carolina Power Company
Springfield, Illinois, City of
Tampa Electric Company
Texas Electric Service Company
Texas Power & Light Company
Tennessee Valley Authority
Virginia Electric & Power Company
Worcester County Electric Company of Massachusetts
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

American Blower . . . a time-honored name in air handling

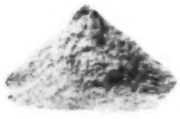
This filter collects the residue from a burning cigarette

This American Blower Fly Ash Precipitator collects fly ash from burning pulverized fuel


PRIMARY CONCENTRATOR
BREECHING FROM BOILER OR AIR HEATER
BREECHING TO INDUCED DRAFT FAN
SECONDARY VENT FAN
SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

NOTE: ST Precipitators are also available for stoker-fired boilers with or without a secondary system.

Install an American Blower Fly Ash Precipitator in your power plant— and see the difference



AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

LETTERS TO THE EDITOR

Help on Heat

To the Editor:

We should try to find some way to help you get stories of electric heating applications in every issue. This would have many values, but the particular effect which I feel is important is that of helping those of us in the power sales field to recognize that electric heating is saleable, has very definite advantages over fuel type installations, and that industry wants electric heating.

Geo. E. Duerr
West Penn Power Co
Pittsburgh, Pa.

• All offers gratefully received—Editor.

The Missing Link?

To the Editor:

In the Oct. 6 issue, under "Technical Notes," we came across the following statement:

"Very fast and very slow fuses are outside the standardization which embraces only the moderately fast and slow characteristics."

This is just a few lines to advise that the statement may have been true at an earlier date, but we believe, and some of our customers agree with us, that the deficiency has been met by Matthews Slofast Links, described on new page eleven, Bulletin 104-B, dated July 1, 1952.

These links are protected by Patent 2,614,192, dated Oct. 14, 1952, and other patents pending.

Claude L. Matthews
President
W. N. Matthews Corp
3850 Delor St
St. Louis 16, Mo.

DBPC Not Guilty

To the Editor:

We have noted in the "Technical Notes" of Sept. 22 the following statement:

"Inhibitor in circuit breaker oil seems to retard settling of the carbon produced by prior interruptions."

This statement is of particular interest to us because we manufacture an insulating oil inhibitor known to the trade as DBPC (di-tert-butyl-paracresol). As this inhibitor is widely accepted by the utility industry, we are assuming that it is the one being talked about.

An article by Dr. William Leeds, manager, Circuit Breaker Development, Switchgear Division, Westinghouse Electric Corp, East Pittsburgh, and R. F. Seubert, manager, Oil City Products Branch, Chemical Division, Koppers Co, Inc, Pittsburgh, entitled "OCB Operation Unaffected by DBPC" appeared in the July 28 issue of Electrical World in which it was concluded that "DBPC inhibited oil subjected to arcing apparently shows no definite characteristic with respect to the rate of carbon settling under the usual variety of operating conditions." This short article was but a brief summary of a coperative test program by the Westinghouse Electric Corp and the Koppers Co.

E. D. Andrews
Manager
Oil City Products Branch
Koppers Co, Inc
Oil City, Pa.

• Reader Andrews is correct.

Favors Electric Heating

To the Editor:

I note in the Electrical Week section of Sept. 29 some comments on the attitude of the Provincial Electricity Commission on electric house heating. In this you state, "The Provincial Electricity Commission has virtually forbidden the private companies under its jurisdiction to engage in electric house heating despite occasional urging by Chambers of Commerce."

It is my belief that you do your best to report actual facts in this column, but in this case you have misstated the point.

To date the Provincial Electricity Commission is inclined to favor electric house heating and has, for the last four years, authorized most power companies under its jurisdiction to make a surcharge of $2 per kw of demand in excess of 7.5 kw in all domestic premises where the monthly demand is in excess of 10 kw or where the monthly consumption is in excess of 1,500 kwhr. With the low follow-on rates existing in this province, this makes for a cost of electricity for house heating of approximately 1¢ per kwhr, which we believe to be much too low.

A group of power companies has jointly petitioned the Provincial Electricity Board to be allowed to apply to electric house heating the same rates and conditions as those applied by Quebec Hydro, the provincially owned electric and gas utility operating in Montreal and the surrounding area. This petition has not been granted to date, and there is every indication that the Provincial Electricity Board does not feel it should set rates that would render electric house heating prohibitive.

Jean Saint-Jacques
Director of Sales and Contracts
Quebec Power Co
229 Rue St. Joseph St
Quebec, Canada

A New Emily Post

To the Editor:

Just a word to let you know that the editorial, "A New Emily Post," appearing in the June 30 issue of Electrical World really had pulling power. To date we have received over 800 requests for our booklet "Code of Courtesy." These requests came from all over the world and included letters from England, Germany, Holland, France, and the South American countries. This figure does not represent the number of reprints which some companies asked us to prepare for them, however.

While the "Code of Courtesy" was written for Interstate Power employees, a number of companies have asked permission to reproduce it. This we have gladly given, and we have had reprints of it in all manners and forms —mimeographed, offset, and in employee publications. We certainly hope that this will prove of benefit to the electrical industry, and we want to thank Electrical World for calling it to the industry's attention.

Mead Schenck
Advertising Manager
Interstate Power Co
Dubuque, Iowa

• It is always a pleasure to call to the attention of the industry such booklets as "Code of Courtesy."

ONAN Auxiliary Electric Plants

Keep customers happy when power's off!

Servicing sometimes requires that highline power be temporarily interrupted. Or storms, floods or fires may cut power to a factory, business or farm and cause severe losses.

To maintain and build customer goodwill in situations like these, many power companies use Onan Electric Plants as temporary sources of electricity. Mounted on truck or trailer they are rushed to the spot, hooked up and operating within a short time.

Onan Electric Plants are built for heavy-duty use to run continuously if necessary. They are trouble-free and economical to operate.

Having several sizes available is most economical since you can fit plant capacity to the electrical load. Onan gasoline-powered plants range from 1,000 to 35,000 watts. Diesel-powered: 3,000 to 55,000 watts.

A SIZE AND MODEL TO FIT ANY JOB

Model 10EL—10,000 Watts. Similar models to 35KW

Model 5GO—5,000 Watts. 4-cylinder heavy-duty engine

Model 3052K—3,500 Watts. 2-cylinder, air-cooled, engine

Write for specifications

D. W. ONAN & SONS INC.

Onan ELECTRIC PLANTS

5433 University Avenue Southeast — Minneapolis 14, Minnesota

WHAT THEY'RE SAYING

At Industry's Meetings

Joint Development Feasible

J. C. CORETTE, President, Montana Power Co, before a luncheon of Security Analysts of San Francisco at San Francosco, Calif.

The joint development of hyrdo-electric projects, the entire construction of which is uneconomical from a private enterprise standpoint, would bring maximum benefit to the country. This could be accomplished without sacrificing any of the potentialities of the site. The private power company could construct, install and operate the electric facilities while the government could build the dam and facilities for other multi-purpose benefits. Private ownership of the electric facilities would add that much more to the tax rolls through property and income taxes while subtracting from government expenditures.

Such a proposal was made regarding the 50,000-kw Canyon Ferry project in Montana. This proposal was accepted by the 80th Congress but was later rejected by the 81st. Montana Power Co could very well enter into such a joint development with the government of the proposed multi-purpose Yellowtail project (ultimate capacity of 200,000 kw) located near their F. W. Bird steam station at Billings.

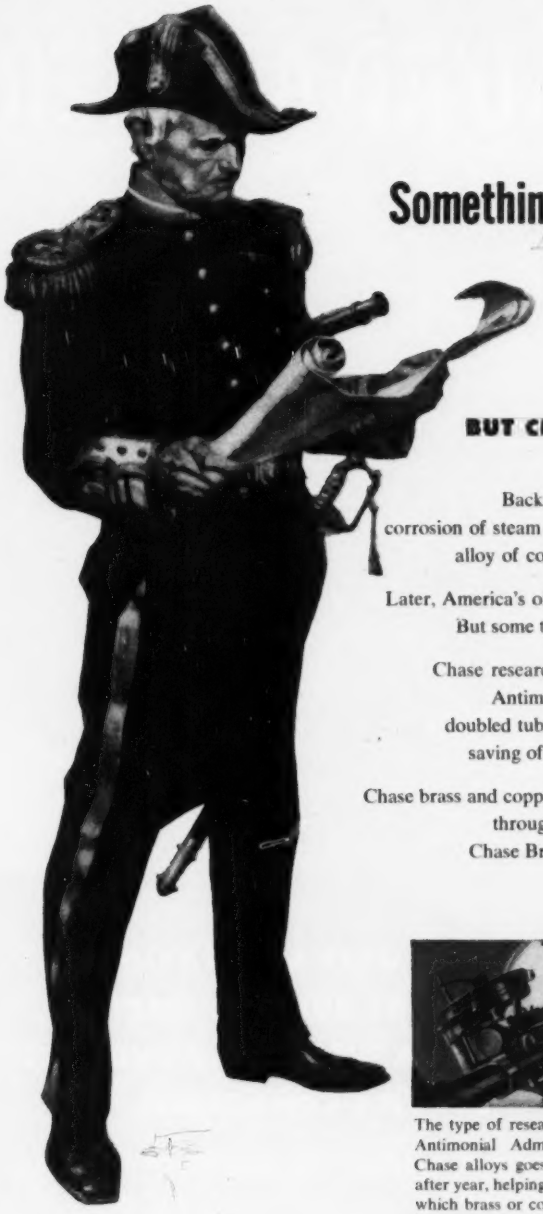
Dependence on Government

WILLIAM H. WARD, vice-president and director, E. I. DuPont de Nemours Co before the Paint, Varnish and Lacquer Association at Cleveland, Ohio

The American people can lose the very security they desire if they depend too much on their government. The real source of economic security is our technology and our system of industrial production. The government could not even dream of the programs it promotes if it were not for the wealth our technology produces.

Too many people regard government as the source of security and expect it to see that their economic present and future are cared for by the government. Economic security lies primarily in the production of wealth, and the government does not produce wealth. The majority of Americans do not recognize the true source of

(*Continued on page* 160)



Something the Admiral didn't know

BUT CHASE RESEARCH LATER DISCOVERED

Back in 1870, British ships were often put out of action by corrosion of steam condenser tubes. To make these tubes last longer, an alloy of copper, zinc and tin called "admiralty" was developed.

Later, America's oil industry used "admiralty" tubes in heat exchangers. But some types of water caused zinc to separate from the copper.

Chase research metallurgists then developed a new alloy – Chase Antimonial Admiralty* which in many instances more than doubled tube life. Alloys of this type have resulted in an estimated saving of $3½ million a year for the petroleum industry alone.

Chase brass and copper alloys are available, subject to government controls, through jobbers and Chase's 23 convenient mill warehouses. Chase Brass & Copper Co., Incorporated, Waterbury 20, Conn.

*U. S. Pat. No. 2,061,921

The type of research that developed Antimonial Admiralty* and other Chase alloys goes on at Chase year after year, helping industry determine which brass or copper alloy is suited to each industrial need.

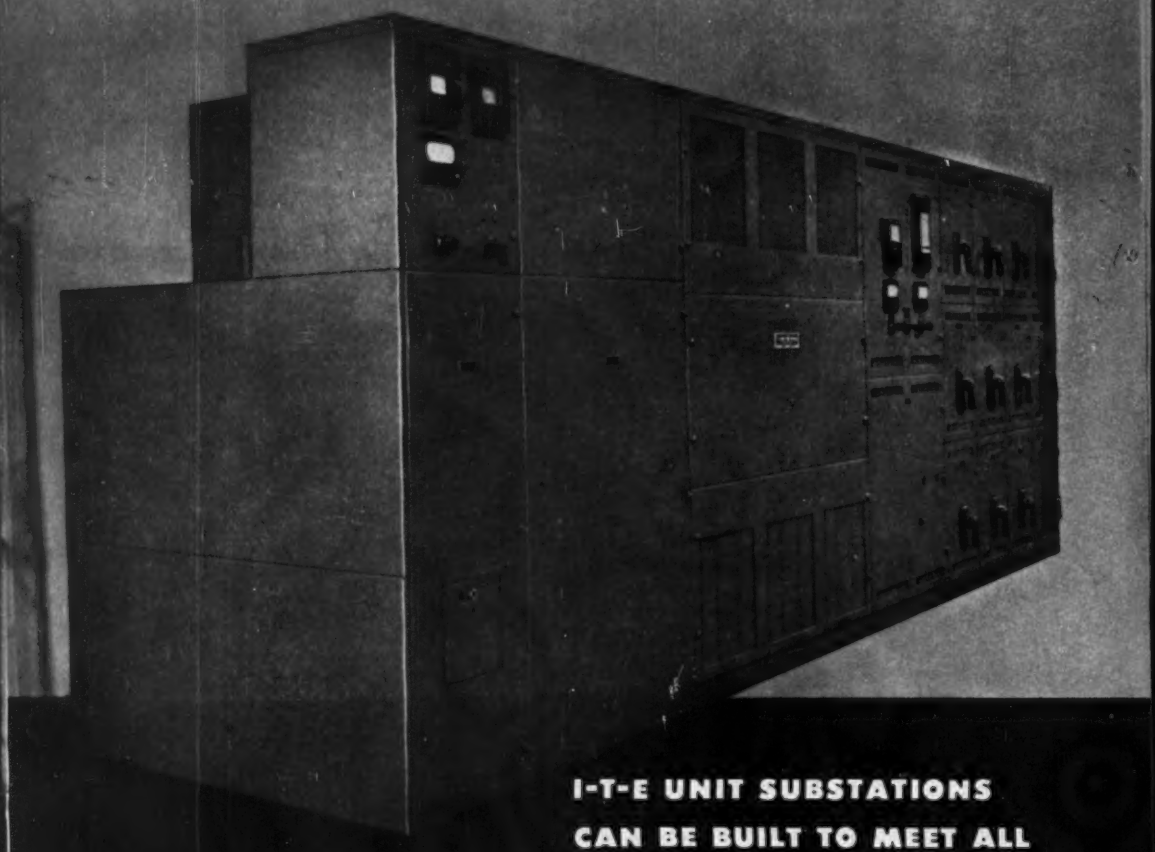
Telnic® Bronze, another Chase development, makes better aircraft instrument parts, radar tubes and other electronic equipment. It was "tailor-made" for industry by Chase research metallurgists.

Chase *The Nation's Headquarters for* BRASS & COPPER

Chase Brass & Copper Co. is a subsidiary of KENNECOTT COPPER CORPORATION

CHASE BRASS & COPPER CO., WATERBURY 20, CONN., Warehouses and Sales Offices at:— Albany† Atlanta Baltimore Boston Chicago Cincinnati Cleveland Dallas Denver† Detroit Houston† Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York Philadelphia Pittsburgh Providence Rochester† St. Louis San Francisco Seattle Waterbury (†sales offices only)

HOW MUCH WOULD A POWER



TRANSFORMER TYPES INCLUDE:

OISC
Non-inflammable liquid-filled
Class B air-cooled (illustrated above)
Class H air-cooled
Class H, nitrogen-filled, sealed tank

I-T-E UNIT SUBSTATIONS CAN BE BUILT TO MEET ALL NEMA "USUAL and UNUSUAL" SERVICE CONDITIONS

Indoor and outdoor—in any required ratings

YOU SAVE THROUGH—

1. Better voltage at point of use.
2. Lower conductor cost—shorter runs of LV cable.
3. Shorter installation time—Substations shipped as complete packages.
4. Use of lower interrupting capacity breakers.

GET THE FULL STORY—

See your local I-T-E representative for details—or write for Catalog Section 9000 today.

FAILURE COST YOUR PLANT?

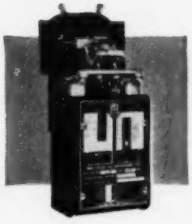
Suppose a prolonged power interruption suddenly hit your plant! How much would it cost you in lost production, down-time—perhaps ruined product, equipment damaged beyond repair?

To all plants, *service continuity* means profits. In some, service continuity is the most important single consideration in planning the vital electrical distribution system.

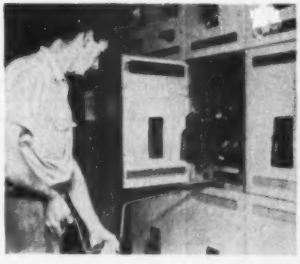
Assure service continuity—Install modern I-T-E Unit Substations

No matter what your service continuity requirements may be, I-T-E can offer you the benefits of long experience—supply the equipment to meet them all. You get:

FLEXIBLE SYSTEM PLANNING. *Sectionalization* (I-T-E Unit Substations strategically spotted throughout the plant) *limits* the area affected by power interruption. You can plan your system to provide immediate restoration of service—or actual *elimination* of interruption on unaffected circuits.



SELECTIVE TRIPPING. Sectionalization can be carried right down to the *individual* I-T-E circuit breaker—the individual machine or feeder. The versatile I-T-E Direct-Acting Selective Overcurrent Trip Device helps *isolate* faults. If there's a sustained overcurrent or short circuit in any branch of the system, only the breaker closest to the fault will open.



MODERN DRAWOUT CONSTRUCTION. Even maintenance requires little or no down-time. With modern I-T-E drawout construction, total outage time during maintenance is only a few minutes. Circuit breakers of like characteristics are interchangeable. One spare breaker—for quick replacement—provides economical insurance for a number of feeder circuits.

I-T-E

UNIT SUBSTATIONS

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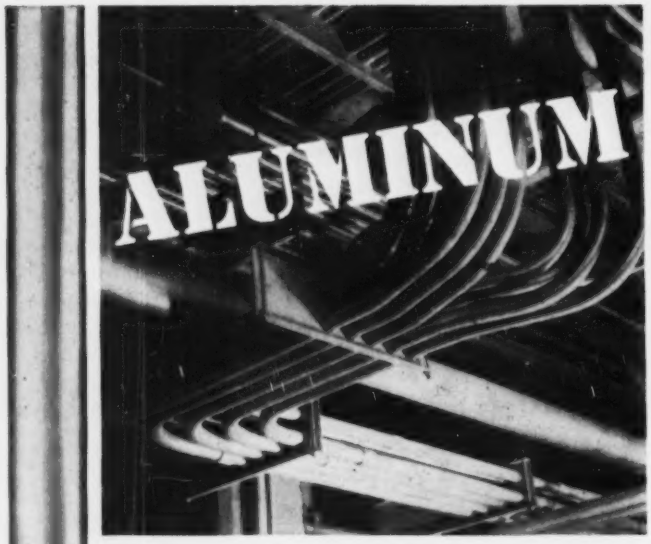
CANADIAN MFG. & SALES: EASTERN POWER DEVICES, LTD., TORONTO • EXPORT SALES: PHILIPS EXPORT CORP., N. Y. 17, N. Y.



Now, Nonmagnetic Conduit at 1/4 the price you'd expect

Alcoa Aluminum Rigid Conduit sells for about 75 per cent less than other nonmagnetic conduit. Because of its nonmagnetic properties, Alcoa Conduit permits each conductor of a single or polyphase system to be separately enclosed, regardless of electrical load. It simplifies installation of equipment having widely spaced terminals . . . eliminates overcrowding terminal enclosures.

Alcoa Conduit is 2/5 lighter than steel conduit of equal size and length. Actual construction records show savings due to easier handling and fabricating. Alcoa Conduit resists corrosion by most industrial atmospheres . . . will not stain adjacent surfaces with rust.

ALUMINUM COMPANY OF AMERICA
1936-M Gulf Bldg., Pittsburgh 19, Pa.

For complete information write for Alcoa's new booklet, *Alcoa Aluminum Electrical Rigid Conduit.*

ALCOA
ALUMINUM RIGID CONDUIT

(*Continued from page* 156)

security. The trend in government seems calculated to injure it but they would not be doing this if it did not believe its actions had the support of the majority of Americans.

The average man would agree that industry produces automobiles, refrigerators, and the other goods he enjoys; and that an expanding cycle of production, sales, and employment is desirable. But if you asked him to agree that these things are the strongest guarantee of his personal economic security, then you would probably get an argument, and he would most likely tell you that for real security he looks to the government.

Actually, it is the system of industrial production that makes possible such things as the minimum wage law, the 40-hour week, and social security. We can afford a minimum wage in the United States because we produce enough real wealth to make the wage mean something in terms of the individual recipient. The government of Red China could pass a similar law, but it would be an idle gesture because the country does not produce enough real wealth to make a livable minimum wage stand up.

The 40-hour week in the U. S. has become standard because our technology has developed tools that enable men to produce so much more wealth than they can with their hands, that 40 hours a week is enough. In China, such a short week would be a grim joke because the average Chinese would die of starvation if he didn't work longer than that.

Diesels, Interim Power Source

H. F. BROWN, Westinghouse Electric International Co before the American Institute of Electrical Engineers at Chicago

The new Diesel locomotives which are pushing the old iron horse out of the railroad picture are just an interim source of power.

The diesel actually has most of the characteristics of an electric locomotive carrying its own power plant, freeing it from overhead wires and third rails.

Major improvements are being made in electrical locomotives and with constant research for cheaper power going on it is safe to predict that railway electrification will again be considered. The electric locomotive will supplant the Diesel as the Diesel did the steam locomotive.

services that add up to efficient business operation

Can you keep enough specialists on your company's staff to cope with all the special problems that arise? Few businesses can. Yet, when such problems *do* occur, prompt solutions are imperative. That's why so many progressive firms call on EBASCO for a particular service or combination of services required to maintain efficient operation.

EBASCO makes available to your firm a vast pool of specialized talent... men trained to solve problems involving virtually every phase of business and industry. During the past half century EBASCO has set up industrial relations and pension programs, made sales and marketing studies, and helped to solve production problems. EBASCO engineers have planned and built over a billion dollars worth of new plants. Their financial consultants have advised on the raising of more than two billion dollars in new capital.

This history of solid accomplishment can be brought to bear on your business and industrial problems, regardless of the size of your firm. EBASCO teamwork supplies you with specialized assistance that will pay for itself many times over.

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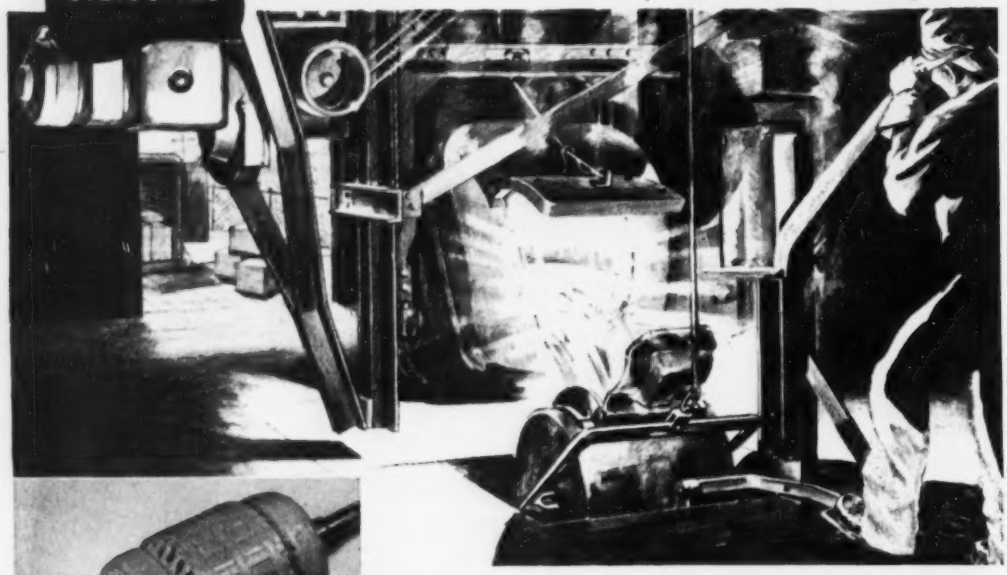
DOW CORNING SILICONES

make motors last longer



Class H motor outlasts Class A 10 to 1 in spite of high ambients, heavy duty and accidental stalling.

Subjected to continuous 24 hour duty to meet increased production schedules, the 4½ hp dc Class A insulated transfer crane motors in a large midwestern foundry had a service life of only 2 to 3 months. Life for these overworked motors was further complicated by trips to the furnace at least once every 15 minutes where ambient temperatures run as high as 180° F.

After repeated failure, the rewind shop recommended Class H insulation. The first of these motors to be rewound with Silicone (Class H) insulation has now been subjected to such service for more than 2 years. During that period, the windings were exposed 4 times to temperatures far beyond the limits of any other class of insulation when the motor was accidentally stalled by broken armature bands. Four times it was simply rebanded, coated with silicone varnish, baked and quickly returned to service.

That kind of performance in thousands of installations proves that Class H insulation has 10 to 100 times the life expectancy of the next best class of insulating materials; withstands high ambient temperatures,, reversing service, sustained overloads, and excessive moisture for long periods of time. It pays for itself over and over again in increased productivity and lower maintenance costs.

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- ☐ List of Class H motor repair shops.
- ☐ Data on Silicone Grease for motor bearings.
- ☐ 32-page booklet entitled "What's A Silicone?"

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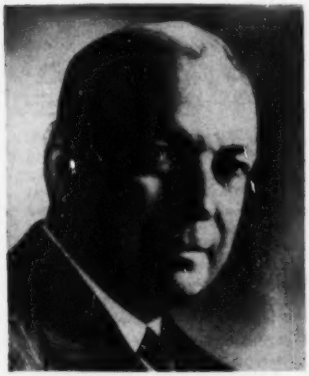
NEWS ABOUT PEOPLE

Hall Is Named Head of NEMA

Association elects president of Stackpole Carbon as its top official at 26th annual meeting in Atlantic City, N. J.



L. G. HALL

L. G. Hall, president of Stackpole Carbon Co, St. Marys, Pa., has been elected president of National Electrical Manufacturers Association. He succeeds James F. Lincoln, president and general manager, Lincoln Electric Co, Cleveland.

The Stackpole Carbon official was elected to the presidency of NEMA at the association's 26th annual meeting held recently at Atlantic City, N. J. (EW, Nov. 24, p 46).

Hall, who was graduated from Yale University in 1910 with a AB degree, started working for Stackpole Carbon in 1912 and four years later was elected secretary and treasurer of the company.

Served as General Manager . . . After serving with the Army as a lieutenant during World War I, Hall resumed his duties as secretary and treasurer of Stackpole Carbon and in 1921 was made general manager and treasurer. In 1928, due to the growth of the company, another general manager was named and Hall continued to perform only the duties of secretary and treasurer.

In 1938 he was elected president of the firm. He took on the additional office of treasurer in 1945 and since that time Hall has been president and treasurer.

Hall has been a member of NEMA's board of governors since 1945 and served as treasurer of the association in 1951 and 1952. Hall is the 23rd president of the organization.

•

T. J. Newcomb has been appointed manager of Westinghouse Electric Corp's Television-Radio Division with headquarters at Sunbury, Pa. Newcomb, formerly sales manager of Westinghouse's Appliance Division at Mansfield, Ohio, succeeds **F. M. Sloan,** who was named manager of operations for the division. The company also has named **Richard J. McCusker** as the division's assistant sales manager; **Frank H. Barnett,** manager application engineering; and **Wilbur H. McKnew,** assistant manager application engineering.

Joseph E. Cushman, division manager at Preston, Idaho, for Utah Power & Light Co, has been appointed assistant to Vice Pres R. H. Ashworth. **J. Newell Stephens,** who has been division sales manager at Preston since 1944, will succeed Cushman as division manager. Cushman, who joined the utility in 1912, will make his headquarters at Salt Lake City.

C. M. Wagner has been elected president of Texas Power Reserve, a statewide association of rural electric co-ops. Wagner is manager of Nueces Electric Cooperative at Robstown and has completed one year on the TPR board.

George A. Haller has been appointed manager of the Stevens County PUD at Colville, Wash., to succeed **Carl C. Moore,** who has resigned from the manager's post to enter private business in Lewiston, Idaho.

Correction . . . The last paragraph of the story on "Power Department Posts Filled by Allis-Chalmers" (EW, Nov. 10, p 30) was in error. Fred W. Bush is assistant manager of the Power Department of the General Machinery Division of Allis-Chalmers Manufacturing Co.

J. H. Ward Is Advanced by Commonwealth Edison

J. Harris Ward, vice president and secretary of Commonwealth Edison Co, has been appointed vice president and treasurer to succeed George W. Williamson, who has retired.

Ward, who began with Commonwealth Edison in 1938, was named secretary in 1948 and vice president in 1951. This year he was elected vice president and secretary of Public Service Co of Northern Illinois in another step to integrate the operations of Commonwealth Edison and Public Service (EW, April 21, p 182).

Williamson was appointed vice president and treasurer in 1948.

Loughlin Heads NARUC

The new president of the National Association of Railroad and Utilities Commissioners is Eugene S. Loughlin, public service commissioner of Hartford, Conn. Other officers elected were: C. L. Doherty, Rapids City, S. D., first vice president and W. F. Whitney, Madison, Wis., second vice president. J. P. Randolph, Washington, D. C., was re-elected general solicitor and Austin L. Roberts, Jr, Washington, D. C., was re-elected secretary and assistant general solicitor.

•

Floyd A. Garman has been named chief engineer and **Walter V. Magee** assistant chief engineer of the American Steel and Wire Division of United States Steel Co, Cleveland. Garman, formerly assistant chief engineer, succeeds **Harry L. Jenter,** who was promoted to assistant manager of operations of the Cleveland district. Magee has served as division engineer-construction at Cleveland since 1945.

Raymond C. Hodges, assistant superintendent of the Potomac district for Virginia Electric & Power Co, has been appointed district superintendent at Rappahannock. Hodges started with Vepco in 1930 at Charlottesville.

H. E. Ehlers, Jr, has been promoted to the post of assistant general sales manager of the Crucible and Refractories Division of Joseph Dixon Crucible Co, Jersey City, N. J. His

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GREENLEE HYDRAULIC BENDER

Yes, quickly make bends *exactly* as you want them, when you want them, where you want them. Compact, portable Greenlee Hydraulic Pipe and Conduit Bender lets you do this in a jiffy. *One-man operated* to produce smooth, accurate bends in just a few minutes . . . in pipe up to 5", rigid and thin-wall conduit, tubing, bus-bars. Owners report timesavings up to 60% and more, elimination of cost for manufactured bends and fittings, and "clean", tailor-made installations every time. Get facts now on this time-saving tool that often pays for itself on first few jobs! Write for free Bender Booklet, Greenlee Tool Co., 1812 Columbia Avenue, Rockford, Illinois.

GREENLEE

Other GREENLEE timesaving tools for electrical work: Hand Benders; Joist Borers; Cable Pullers; Knockout Tools; Auger Bits and Drills.

former position of manager has been filled by **Ralph Rathyen,** who has been assistant manager of the division since 1951.

New Members Elected to McGraw Award Group

Four additional electrical industry members have been elected to the permanent Committee of Awards, James H. McGraw Award for Electrical Men.

The new members are H. P. Thuerk, president, New Jersey Power & Light Co; R. S. Edwards, president, Edwards & Co; E. B. Ingraham, president, Times Appliance Co., and H. A. Webster, president, T. Frederick Jackson, Inc.

Edwards and Ingraham are recipients of the McGraw Award. Edwards received the Manufacturers Medal in 1948 and Ingraham the Distributors Medal in 1948.

•

Miss Ermalee Moore, former home service director of Oklahoma Gas & Electric Co, has been appointed regional director of home economics for the Central district of Westinghouse Electric Corp's Appliance Division. Miss Moore, who had served Oklahoma G&E for the past 15 years, will now work with utilities, distributors, dealers and educational institutions on sales, demonstrations, and education.

B. W. Alvey, supervisor of water heater sales for the Frigidaire Division of General Motors Corp, Dayton, has been appointed manager of the rural sales, appliance sales department. Alvey replaces **James R. Cobb.** Cobb recently was made manager of home laundry sales to succeed **Fred M. Mitchell,** who in turn became manager of the Roanoke branch of the Frigidaire Sales Corp.

Dr James W. McRae, vice president of Bell Telephone Laboratories, New York, has been elected president of the Institute of Radio Engineers for 1953. He succeeds **Dr Donald B. Sinclair,** chief engineer of the General Radio Co. Dr McRae is also a member of the American Institute of Electrical Engineers.

C. D. Bradrick, formerly manager of industrial engineering for the manufacturing department of General Electric Co's Air Conditioning Divi-

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IN THE FIELD as in laboratory tests . . . *Crapo* Galvanized Steel Strand proves itself capable of withstanding severe punishment. Steel's inherent strength and durability are combined with definite economies in every size and grade of *Crapo* Steel Strand. You'll find the heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

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ELECTRIC POWER CONNECTORS

OUTDOOR SUBSTATIONS

MEMCO ENGR. & MFG. CO., INC.
COMMACK, L. I., N. Y.

sion, has been named manager of manufacturing of GE's heat pump department. He joined GE in 1950.

Elects 1953 Officers

The American Welding Society has elected Fred L. Plummer, director of engineering, Hammond Iron Works, Warren, Pa., as its president for 1952-1953. The society has also elected the following officers: Eric R. Seabloom, Crane Co, first vice president; J. H. Humberstone, Air Reduction Co, Inc, second vice president; Donald B. Howard, American Car & Foundry Co, vice president of the Middle Eastern district; John H. Blankenbuehler, Hobart Bros. Co, vice president of Central district; and J. E. Dato, Linde Air Products Co, vice president of Mid-Southern district.

•

Endicott Newhall, merchandising supervisor of ballast and transformer activity for Sylvania Electric Products, Inc, has been appointed sales manager of the new electronic transformer department added by the sales department of the firm's Lighting Division. Newhall started with Sylvania in 1931.

R. T. Porter, Athens Division superintendent of Georgia Power Co, has been made assistant to the operating manager of the company. Other changes in the utility's operating department include: **B. W. Sinclair,** superintendent of production and construction; **L. B. Locklin,** assistant superintendent of production and operation, named to replace Sinclair; **A. B. Greene, Jr,** assistant superintendent of production-construction, made superintendent of generating plant construction; and **R. W. Causey,** superintendent of Plant Atkinson, named assistant superintendent of production.

Charles L. Bullock has been named manager of Ohio Power Co's Central Division commercial industrial department. Bullock has been succeeded as assistant manager of the department by **Robert H. Masters,** an industrial power engineer. Bullock began with Ohio Power 29 years ago and Masters joined the utility in 1927.

R. L. Lloyd has been appointed general manager of advertising and **R. A. Wheeler** assistant general manager of

MARCUS DRY TYPE transformers

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first with Quinterra Insulation

NOW... first

with HI-HEAT HI-DIELECTRIC Magnet Wire

Nothing is ever considered so good at Marcus that improvement isn't searched for constantly. Since insulation is the heart and backbone of any transformer, Marcus is proud to announce its use of the first real advancement in Class B insulated magnet wire in 12 years. The combination of Johns-Manville *Quinterra* with DuPont *Mylar* and *Dacron* not only provides exceptional heat resistance but dielectric strength as high as 10 times that of the present industry standard. Failure at such vulnerable points as turn-to-turn and layer-to-layer becomes a virtual impossibility. Moreover, another Marcus first, *Quinglas*, having unusually high physical strength, adds extra protection between layers.

Insulation levels never thought possible or economical with dry type transformers are now available from Marcus, one of the largest manufacturers in the world of dry type transformers exclusively. Capacities from 1 to 3000 KVA, up to 15,000 volts.

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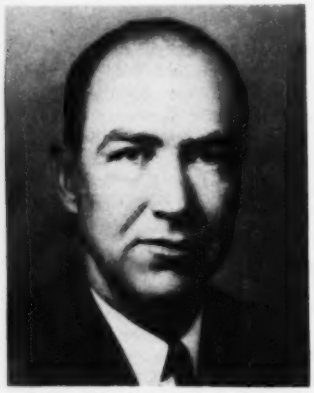
advertising of International Nickel Co, Inc. In consolidating into one department the advertising sections of nickel sales and Inco nickel alloys departments under Lloyd and Wheeler, the company also named **M. J. Phillips** assistant to the general manager of advertising and **H. S. Lewis** and **A. P. More** assistant managers of advertising.

Earl L. Carlson has been promoted to superintendent of the Northern Division of Puget Sound Power & Light Co. Carlson, formerly assistant division superintendent, replaces **Douglas Olds,** who has retired after 42 years' service.

OBITUARY



Richard F. Pulver

Richard F. Pulver, 53, vice president and general sales manager of Minnesota Power & Light Co. died Nov. 8 at Minneapolis.

Pulver joined Minnesota P&L in 1924. He was named general sales manager in 1941 and vice president and general sales manager in 1944.

He was a past president of the North Central Electric Association and past chairman of the North Central Electrical Industries.

Samuel J. Mayhew, consulting engineer for production for Pennsylvania Electric Co, died at Johnstown, Pa., Nov. 10. Prior to his appointment to the consulting post two months ago, Mayhew had served as superintendent of the production department for the entire Pennsylvania Electric system. He had served the utility for 40 years.

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Practical methods of electrical wiring, explained in plain, easy language. Tells how to do all kinds of light and power wiring jobs in the profitable home, farm, and factory market, and presents the basic principles behind them. Fourth Edition based on the 1951 National Electrical Code . . . emphasizes newer methods . . . gives more information on farm wiring . . . includes full information on standby generating plants. **By H. P. Richter. 4th Ed., 370 pp., 5½x8, 478 illus., $6.50**

NATIONAL ELECTRICAL CODE HANDBOOK

New Seventh Edition completely revised to conform with the 1951 National Electrical Code requirements. It explains the rules and measurements for the various types of jobs—what they mean—how to apply them. All the rules for a job are in one place. Includes everything from special requirements pertaining to hazardous locations to complete tables giving the full-load current, wire size, conduit size, and branch fuse rating of various types of motors. **By Arthur L. Abbott. 7th Ed., 652 pp., 441 illus., $6.00**

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New idea makes Code rules clear at a glance, by pictures. Saves you time and errors; gives a diagram or schematic drawing for every Code rule, showing working meaning. Based on 1951 Code. This volume covers Code chapters on wiring design and protection, and wiring methods and materials. **By B. Z. Segall, Registered Professional Engineer. 754 pp., 8½ x 11, over 1300 illus., $12.50**

THE LINEMAN'S HANDBOOK

That transmission line fact that you want is in this handy guide giving principles, data, methods and cautions on all aspects of the lineman's work. Describes all the materials of the construction: poles, conductors, hardware, tools, electrical apparatus, etc. Information on construction, testing and maintenance shows how to meet problems with right choice of materials and methods. **By E. Kurtz, U. of Iowa. 2nd Ed., 652 pp., 682 illus., $6.50**

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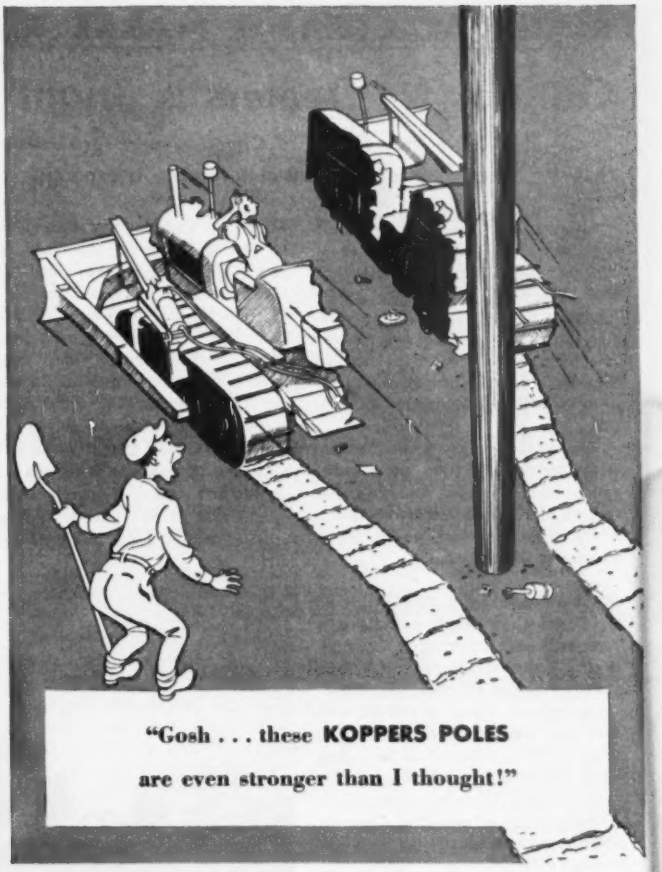

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By retaining their strength through the years, Koppers Poles cut your replacement costs considerably. By giving such trouble-free service, Koppers Poles make your line operation easier and more economical.

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KOPPERS PRESSURE-CREOSOTED WOOD

Outlook for Dealers Is Bright

This group may find 83rd Congress more pro-business than the 82nd. Less government interference is expected

Appliance dealers—as well as business generally—should find little to complain about in the new Congress that convenes in January. The 83rd Congress will be even more pro-business than the 82nd and business can take added comfort from the fact that the administration and regulatory agencies will be considerably less hostile.

This will mean less government interference in the form of controls, taxes, and regulations. And it will also mean a much more friendly climate in which to operate when business brings its case to Washington.

Position Improving . . . There is no legislation which might be classified as "anti-business" in prospect and business will find its position improving as the Congressional year progresses.

On controls, April 30 will see controls on prices and wages expiring and there is little prospect of extending them—short of a worsening of the world situation. Congress came close to dumping them in the 82nd Congress and only a last-ditch effort by administration supporters in Congress got them extended to April 30. But at that time the feeling in Congress was that short of general war, price and wage controls had been stretched as far as they could go.

On materials controls, the expiration date is June 30. By that time steel, copper, and aluminum will be in free supply, but there will be enough tightness of certain steel alloying metals to warrant some kind of controls provision.

Stand-by Controls? . . . But rather than extend controls broadly, Congress likely will keep them on a stand-by basis, perhaps with some provision for military priority for such steel alloying metals as nickel, columbium molybdenum, tantalum, and cobalt.

Taxwise, the picture for business will begin to improve on June 30, when the excess profits tax expires. There is little or no chance of extending it, which raises the question of whether it shouldn't be accompanied by like tax relief for individual taxpayers. The Korean War-voted individual income tax increase of 10 to 11% passed in 1951 will expire as of Jan. 1, 1954. There is some thought of setting the expiration date forward to June 30, 1953, so that the Republican Congress can't be indicted for granting relief to business only.

There is still some question of whether a tax bill will be written during the first session. Congress will be occupied in its first months with appropriation bills and it would be difficult to write a tax relief bill until Congress has the full picture of what it's going to cost to run the government for another year.

But against this there is the argument that the new administration must press for some form of tax "dividend" early in the session in order to make good on campaign promises.

Excise Tax Relief . . . If Congress does decide to put through a tax bill, there will be pressure from numerous directions for excise tax relief. This will be led by the liquor industry, and will number several appliance items, particularly where the tax is on the retailer. The booming radio and television industry is not going to press for repeal of the 10% excise tax now levied on manufacturers. The industry is much more interested in getting rid

A Turbine Pioneer Is Honored

Seven-year-old Billy Emmet, of Del Ray, Fla., namesake and great grandnephew of the late W. L. R. Emmet, is shown at foot of memorial plaque which he unveiled recently at General Electric Co, Schenectady, N. Y.

Emmet, a GE turbine engineer, was the first to apply electric drive for ships, a pioneer in designing apparatus for utilities, and the man who built the first turbine to operate from mercury vapor instead of steam.

Unveiling ceremony marked the 50th anniversary of the starting of GE's first turbine generator at Niagara Falls. This unit is still in operation at Niagara Mohawk Power Corp's Adams Station No 2.

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of excess profits tax and thinks excise tax repeal should be held back for the time when it could serve as stimulus for a lagging market.

Credit Controls . . . There is little prospect of reimposition of any kind of credit controls, such as embodied in Regulation W. However, if materials shortages or unusually heavy demand should put an inflationary pressure on the appliance market, the administration would be more apt to meet it through credit controls similar to Regulation W, rather than renewing or extending general price controls.

It all adds up to the general outlook of less government in business during the coming administration.

Olin Gets DPA Go-Ahead to Build Aluminum Project

Olin Industries, Inc, East Alton, Ill, has been given the go-ahead signal by the government for the construction of $170 million of facilities for the production of more than 110,000 tons of primary aluminum annually and the fabrication of products.

The Defense Production Administration has issued "certificates of necessity" entitling Olin to write-off in five years, as depreciation for tax purposes, a major part of the cost of the privately financed facilities. Normal depreciation period allowed under tax laws is 20 to 25 years.

DPA spokemen said that in addition to the facilities necessary for the production of primary aluminum, fabricating plants to produce about 40,000 tons of wide, high-strength aluminum sheet and an estimated 12,000 to 15,000 tons of aluminum extrusions are included. Location of the operations has not been determined.

Cost of the primary aluminum plant is estimated at $123.3 million and tax certificates applying to 85% of the investment were granted. The sheet, plate, and extrusion unit will involve an investment of $45.5 million on which tax certificates covering 50% of the cost were allowed.

DPA's action is in line with its program to bring new American producers into the field rather than rely on foreign sources or the American "big three"—Aluminum Co of America, Reynolds Metals Co, and Kaiser Aluminum & Chemical Corp. Olin is the second newcomer to enter the field. It was preceded last year by Anaconda Copper Mining Co.

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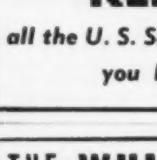

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NEW ELECTRICAL CONSTRUCTION

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UTILITIES

Proposed Construction

Calif., Mount Eden—Western Electric, 315 Montgomery St., San Francisco and Pacific Telephone & Telegraph Co., 140 New Montgomery St., San Francisco, 399,000 sq. ft. distributing house and transportation center, William St. and Doolittle Dr., Eden Twp. $4,700,000.

Calif., Vallejo—Twelfth Naval Dist., Room B-114, San Bruno, Calif. electronics shop bldg., NOY 75169, Spec. 53367. Plans deposit $175.

D. C., Wash.—U. S. Eng., First and Douglas Sts. N.W., cold storage and meat cutting plant, at Bolling Air Force Base ENG 49-040-53-34-(28), $100,000-$500,000. Plans deposit $25. Extended date.

Fla., Bartow—City, City Hall, power plant imprvs. $125,000.

Ga., Waycross — Teletronics, Inc. (WACL), P. O. Box 858, Waycross, television station $101,000. W. J. Holey, 822 N. Highland N. E., Atlanta, consult. engr.

Idaho—Bureau Reclamation Dpt. Interior, Bldg. 53, Denver Federal Center, Denver, Colo., power transformers for Palisades Power Plant, Palisades Proj., Spec. DS 2812.

Ind., Fort Wayne—Westinghouse Radio Stations Inc., (WOWO), 1625 K St. N.W., Wash., D. C., television station, $606,000.

Ind., Terre Haute—John R. Figg, 510 Hawthorne Dr., Bloomington, television station. $294,000.

Ky., Lexington—West-Bingham Television Co., 1133 W. Winchester Rd., television station, $239,000, William L. Foss, 927 15 St. N. W., Wash., D. C., consult. engr.

Ky., Lexington—U. S. Eng., 820 W. Broadway, Louisville, Zone 3, substation revisions, Lexington Signal Depot, Eng. 15-029-53-24.

La., Baton Rouge—Tom Potter, 1032 Life of America Bldg., Dallas, Tex., television station, $393,000, E. C. Page, Bond Bldg., Wash., D. C., consult. engr.

Md., Annapolis—P. Wks. Office, U. S. Naval Academy, Annapolis transmitter facilities, U. S. Naval Radio Station, Spec. 31638. Plans deposit $40.

Md., Bethesda—Dist. P. Wks. Office, Potomac River Naval Command, Naval Gun Factory, Wash., D. C., communication and lighting systems National Medical Center, NOY 75424.

Mich., Bay City—James Geritt Jr., (WABS), Deer Park, Adrian, television station, $432,000. A. Earl Cullum Jr., 4710 Lemmon Ave., Dallas, Tex., consult. engr.

Mo., Clayton—The Lutheran Church, Missouri Synod (KFUO), 210 N. Broadway, St. Louis, television station, $590,000, George E. Gautney, Warner Bldg., Wash., D. C., consult. engr.

Mo., St. Louis—Missouri Valley Television Co., c/o Stanley Hubbard, pres., Radio Station, KSTP, St. Paul, Minn., television station facilities, incl. 870 ft. tower, etc. $200,000.

New Mexico—San Miguel Electric Cooperative, Mora, 100 mi. 7.2/12.5 KV electric distr. lines, at Mora, $177,000. Cecil M. Hawk & Assoc., 1641 Broadway, Lubbock, Tex., consult. engrs.

N. C., Kinston—City, voted bonds, power plant addn. $750,000.

O., Cleveland—WGAR Broadcasting Co., Hotel Statler, television station, $811,000. Robert A. Fox, c/o owner, engr.

O., Cleveland—WJW, Inc., 1375 Euclid Ave., television station, $497,000. George C. Davis, Munsey Bldg., Wash., D. C., consult. engr.

O., Toledo—Unity Corp., Inc., (WTOD) 515 Madison Ave., television station, $619,000. McIntosh & Inglis, Wyatt Bldg., Wash., D. C., consult. engrs.

Pa., Pittsburgh—Pittsburgh Radio Supply House, 411 Seventh Ave., plans by Harry Viehman, 411 Seventh Ave., television station, tower, control station, $1,170,000.

Tex., Austin—Station KTBC, Littlefield Bldg., television station, $150,000.

Tex., Lubbock—Texas Telecasting Co., Whiteside Bldg., television station, incl. 1,000 ft. antenna tower. Approx. $300,000. Butler-Brasher Co., 412 Avenue M, engr.-archt.

Tex., Lubbock—State KTUB, Lubbock, new television station unit, $145,000.

Va., Monogram—P. Wks. Office, Fifth Naval Dist., U. S. Naval Base, Norfolk, five structural steel radiators (towers) one at 800 ft. and four at 300 ft. high, electrical work, concrete foundations, NOY 28492. Spec. 20127. Plans deposit $20. Marcellus Wright & Son, 100 E. Main St., Richmond, Va., and Frank Grad & Sons, 1633 Connecticut Ave., N. W., Wash., D. C., engrs.

Washington—Big Bend Electric Cooperative, Ritzville, 352 mi. rural distr. line, headquarters facilities and system imprvs., Adams Co. $1,260,000.

Wash., Richland—U. S. Atomic Energy Comn., Hanford Operations Office, P. O. Box 550, electrical distr., street lighting, fire alarm and telephone systems for new housing addn.

Low Bidders & Contracts Awarded

Mo., Kansas City—Swenson Constr. Co., 3305 Terrace St., Kansas City, Mo. CA $400,000. Cold storage plant addn. Mid-Central Fish Co., 1656 Washington St., Kansas City, Mo. Bids Oct. 3.

Ohio—Ohio Power Co., 301 Cleveland Ave. S. W., Canton, O. Own Forces, 203 mi. 230 volt high transmission line from Muskingum River Generating Station at Beverly to Lima, in Washington, Morgan, Perry, Fairfield, Licking, Franklin, Delaware, Union, Logan, Hardin and Allen Counties, $9,700,000; sub-station at near Lima, $2,200,000. American Gas & Electric Service Corp., 30 Church St., New York 8, N. Y., consult. engrs.

S. C., Charleston—W C S C, Inc., 474 E. Bay St., Charleston, S. C. Owner Builds. $100,000. Television station.

Tennessee—Tennessee Valley Auth., New Sprankle Bldg., Knoxville, Tenn., Owner Builds. $683,000, primary electric sub-station, Columbia.

Texas—Bartlett Electric Co-operative, Bartlett, Tex., Own Forces, $118,000, 45 mi. rural distr. lines, some sys. imprvs., Bell Co.

Texas—Bernard Electric Co-operative, Bellville, Tex. Purchase and Hire. $90,000. rural distr. lines, at Bellville, Austin Co.

Tex., Corpus Christi—Central Power & Light Co., 120 N. Chaparral St., Corpus Christi, Tex., Force Account, $110,000. addnl. unit of underground cable, northwest sect. of Nueces Co.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Calif., Anderson—Shasta Plywood, Inc., Anderson wood panels mfg. plant, $1,566,000.

Ill., Chicago—Northwestern University, 607 Clark St., plans by Holabird & Root & Burgee, 180 N. Wabash St., Zone 1, 10 story hospital on downtown campus. $10,000,000.

Ky., Louisville—City, City Hall, voted $4,000,000 bonds, adult education bldg., addnl. bldgs. at University of Louisville.

O., Columbus—Bd. Trustees, Veterans Memorial, c/o Comrs. Franklin Co., Court House, Franklin County Veterans Memorial Bldg., north of W. Broad St. between Scioto River and N.Y.C. R.R. $3,300,000.

Okla., Oklahoma City—Baptist General Conventions, 1141 N. Robinson St., plans by Noftsger & Lawrence, 2756 N.W. 23 St., 500-bed hospital and school of nurses. $3,000,000.

Tex., Orange—Goodrich Gulf Chemicals, Inc., Orange (Parent Owners, B. F. Goodrich Co., 500 S. Main St., Akron, O. and Gulf Oil Corp., Port Arthur, Tex.), petrol chemical plant, 701-acre tract. $15,000,000.

TECHNICAL LITERATURE

Electrical Equipment For Cotton And Rayon Mills—A new 35-page booklet on electrical equipment for cotton and rayon mills is now being distributed. Emphasizing that substantial savings can accrue from application of modern electrical apparatus, this booklet describes a complete line of electrical equipment for cotton and rayon mills—from switches to bleaching range drives. Lint-free motors, totally-enclosed Life-Line motors, and Life-Line gear-motors are among the individual products whose construction, operation, and application characteristics are discussed. Also among the equipment described are packaged-type AV adjustable speed drives, beamer and slasher drives. For a copy of this booklet, B-4799, write Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Wiring and Installation—A new manual, entitled "Here's How Turbonics Will Assist You In Solving Your Complicated Wiring System and Insulation Problems", describes a new science developed for determining insulation characteristics in order to insure lasting performance. The manual explains how to obtain pertinent information required to permit uninterrupted operation of any electrical unit or component from a wiring and insulation point of view. This new manual is available to industrial manufacturers of electrical and electronic equipment requiring more efficient assembly operations and higher performance characteristics of wire and insulation. Just write Robert Robinson, The William Brand and Company, Inc., North and Valley Streets, Willimantic, Conn.

First Aid—The National Safety Council's new safetygraph "Two Methods of Artificial Respiration" provides a ready aid in teaching small groups the "arm-lift back-pressure" and the "hip-lift back-pressure" methods of artificial respiration. Although these two methods of reviving drowning and electrical shock victims have proved more effective than the widely-used Schaefer system, few workers have been instructed in their use. Information may be obtained by writing the National Safety Council, 425 North Michigan Ave, Chicago 11, Ill. The safetygraph will be sent on approval for a five-day free examination.

EEI-NEMA Standards for Wet-process Porcelain Insulators—The following standards for wet-process porcelain insulators have just been published jointly by the Edison Electric Institute and NEMA: Standards for Suspension-type Insulators, NEMA Publication No 140-1952; Standards for Spool-type Insulators, NEMA Publication No 141-1952; Standards for Strain-type Insulators, NEMA Publication No 142-1952; Standards for Low- and Medium-voltage Pin-type Insulators, NEMA Publication No. 143-1952; Standards for High Voltage Pin-type Insulators, NEMA Publication No 145-1952. For further information about these standards write National Electrical Manufacturers Association, 155 East 44 St New York 17, N. Y.

Lighting Industrial Plants—A new 40 pg Industrial Lighting booklet has recently received full approval of the A.S.A. and is being published by the sponsor, the Illuminating Engineering Society, 1860 Broadway, New York, N. Y. Completely revising the first recommended practice on this vital lighting problem published ten years ago, the new standard is designed to meet today's superior lighting requirements and covers many specific lighting problems not included in the 1942 report. Necessary quantities of illumination; qualities of light sources; distribution and diffusion; brightness ratios and reflectance values of surrounding areas; are also explained and recommended.

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BOOK REVIEWS

Microwaves

Essentials of Microwaves. By Robert B. Muchmore. Published by John Wiley & Sons, Inc., New York 16, N. Y. 236 pages, illustrated. Price $4.50.

Commendable effort has been made to minimize the mathematics and rely on physical interpretation and analogues so that the low frequency engineer can ride the megacycle waves intelligently. Thus there is transition from wire circuits to coaxials and wave-guides and thence to cavities, klystrons, travelling-wave magnetrons. From the practical application angle there is discussion of beaming, noise, relaying for long distance transmission and choice of appropriate frequency. There is, however, little inclusion of commercial apparatus.

Welding Metal

Weldability of Metals. Published by The Lincoln Electric Co, Cleveland 17, Ohio. 141 pages. Price 50 cents in USA; 75 cents elsewhere, postage paid.

This book gives the answers on how to weld ferrous and non-ferrous metals. The various types of carbon and alloy steels are described by giving nominal chemical analysis, properties, uses and characteristics. The best welding procedure for each is completely detailed. American Welding Society specifications for electrodes used to weld are also given. The same treatment is given to copper, aluminum and nickel as well as their various alloys. Cast iron, forgings, cast steel, wrought iron, ingot iron, galvanized steel, terne plate and enameling stock are similarly covered. A thorough analysis of the principles and practices of hard-surfacing is presented. Complete tabular data, drawings and pictures supplement the text.

Electrophysics

Theory of Electric Polarisation. By C. J. F. Bottcher. Published by Elsevier Publishing Co, Houston, Tex. 492 pages, illustrated. Price $10.

This, it should be made clear, is primarily a treatment of dielectrics rather than electrolytic polarization (to use the American spelling). Foundation is laid by studying the electric dipole and the displacement that accounts for polarization. Effects of low voltage alternating field, of optical frequencies (electrolytic refraction), determination of permanent dipole moments (gases and solutions), polarization at high frequencies (dielectric losses), piezoelectricity are some of the facets of polarization analyzed mathematically.

Nucleonics

The Elements of Nuclear Reactor Theory. By Samuel Glasstone and M. C. Edlund. Published by D. Van Nostrand Co, Inc., New York 3, N. Y. 416 pages, illustrated. Price $4.80.

Up to now national security has dictated withholding of some of the knowledge of nuclear reactions. Under official release these two AEC authors have told the first complete assembly of the rudiments. Of course, those who are chosen to operate the power reactors when they have been practicalized are likely to be those who know most solidly what the reactions really are. Any who aspire to such opportunities either as operatives or supervising engineers can do no better at this stage than to study this lucidly prepared text. Nothing beyond the calculus is introduced in the supporting mathematics. How long before a reactor becomes "poisoned"? How critically does reactor stability depend on minimized temperature fluctuations? These are just two of the multitude of questions answered in understandable terms.

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The Tennessee Valley Authority wants Electrical Engineers to assist in the design, construction, and operation of large steam electric and hydroelectric projects and transmission systems. Salaries start at $3700, $4450, and $5325 for 40-hour week. All jobs carry automatic within-grade increases for satisfactory service, liberal vacation leave, sick leave, and retirement benefits. Design jobs are in Knoxville and Chattanooga, Tennessee. Field construction and operations jobs are at various sites in the Tennessee Valley area and at Paducah, Kentucky. Write the

TENNESSEE VALLEY AUTHORITY
Division of Personnel
KNOXVILLE TENNESSEE

ASSISTANT OFFICE ENGINEER

Recent electrical engineering graduate with some practical experience in office work and procedure, for work large Copper Company, Chile, South America. 3-year contract.

FIELD ELECTRICAL ENGINEER

Whose duties would be to supervise the work done by the District Electrical Foreman in the various camps. This applies to the Plant with its auxiliary services and covers power distribution and utilization, but in general not power generation or transmission, large copper company, Chile, South America. 3-year contract.

Transportation both ways and salary while traveling paid by Company.

In reply give complete details.

P-6063, Electrical World
330 W. 42 St., New York 36, N. Y.

MRO Man Wanted

If you are middle aged and have knowledge of substation equipment, relays, meters etc., and desire a change then answer this ad.

Maybe you are the 2nd. or 3rd. man in a department and your chances for advancement are poor. Perhaps you'd like to superintend a department of your own. We want a family man who will respond to fair treatment and assume full responsibility. Give full particulars of your experience in your first letter. No boozer or boomer need apply.

P-6113, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

WANTED
Electrical Engineer

Requirements: B. S. degree in Electrical Engineering. 30 years of age or younger. Experience in industrial construction and maintenance work desirable but not necessary.

Position: Assistant to Plant Electrical Engineer.

Advantages: Liberal Life, Health, Accident Insurance and Pension Plan for future security. Good housing and living conditions prevail.

Address: **PLANT MANAGER,**
Celanese Corporation of America,
P. O. Box 444, Cumberland, Maryland.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ELECTRICAL PROPERTY Manager in 35-45 year age bracket. Qualified to handle and administer operating, commercial and construction activities for 10,000 customer property. Experience in multi-source energy dispatch, load-building, and property maintenance and construction essential; familiarity with public relations, wholesale power sales, work with community organization and manpower scheduling desirable. Northeastern location. Starting salary range (dependent on Qualifications) $6,500-$7,500. P-5682, Electrical World.

SALES ENGINEER under 30 years old with a flair for writing wanted. Good job open in advertising department of a well-known instrument company located in New England. P-6095, Electrical World.

TECHNICAL WRITER wanted. If you have a technical background, some sales experience, and can write we have a good job with a future for you in the industrial advertising field. P-6094, Electrical World.

YOUNG ENGINEER wanted who likes to write. Should have some experience in sales work. P-6092, Electrical World.

EMPLOYMENT SERVICE

SALARIED PERSONNEL, $3,000-$25,000. This confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 42 years.) Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

SELLING OPPORTUNITY OFFERED

SALES ENGINEER:—Age 25-35. Electrical Engineering Background, contacting Utilities and Industries New York-New Jersey Area. State—Age, education, experience, references, salary. SW-5957, Electrical World.

SELLING OPPORTUNITY WANTED

GREATER NEW York City and New England Sales. Well established and experienced commission Representative selling Utilities, Wholesalers and Industrials can thoroughly sell an additional principal line. RA-5899, Electrical World.

SUBSTATION EQUIPMENT

TRANSFORMERS

Qu.	KVA	MFR.	VOLTAGE
4	500	Pitts.	66000/33000—13200/23000 Y
4	500	West.	69000—6900
3	200	Pitts.	66000—2300
3	75	A. C.	66000/24000—7200/12470 Y
3	200	A. C.	44000—2400/7200
4	150	West.	44000/33000—2300/6900
3	100	G. E.	44000—2300
3	75	West	44000—7200/12470 Y
6	25	G. E.	44000/22000—2200/480
4	5000	G. E.	40925/70960 Y—14500
3	5000	G. E.	28100/66000—6600
1	18750	A.B.B.	34840—11000, 3 ph.
2	5000	West.	33000—26400/13200, 3 ph.
3	200	A. C.	34500—2400/7200/12470 Y
4	200	G. E.	34500—230/460
3	100	West.	33000—240/480 NEW
3	100	A. C.	33000—7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
6	2125	G. E.	26400/13200—2300
4	1500	A. C.	25400/44000 Y—6900/11800
4	450	A. C.	25410/44000—13200/23000
6	100	G. E.	22000—7200/12470 Y
9	50	G. E.	22000—2300
1	4000	Mol.	12800—460, 3 ph.
1	480	Penna.	13200—2400, 3 ph. ASKAREL
2	200	G. E.	13800—2300
1	3750	G. E.	11000—2300, 3 ph.
4	750	G. E.	11000—440
3	500	Mol.	7200/12470 Y—2400/4160 Y
3	250	Pitts.	7200—230/460
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
3	100	G. E.	4800/2400—480/240
3	1500	A. C.	2300/4000 Y—2300
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228, DRY TYPE

INDUCT. REGULATORS—OUTDOOR

1—140 KVA G. E. 200 A. 4000 V. 3 ph.
4—60 KVA West. 250/500 A. 2400 V. 1 ph.
6—48 KVA G. E. 200 A. 2400 V. 1 ph.
3—36 KVA West. 150/300 A. 2400 V. 1 ph.
2—36 KVA G. E. 75/150 A. 4800 V. 1 ph.

CIRCUIT BREAKERS

1— 600 A. 73 KV G. E. FHKO-23-500 MVA
1— 600 A. 37 KV G. E. FHKO-236-500 MVA
3—1200 A. 15 KV G. E. FHKO-139-350 MVA
4— 600 A. 15 KV G. E. FHKO-139-750 MVA
1— 600 A. 15 KV G. E. FHKO-136-250 MVA
1— 400 A. 15 KV. G. E. FHKO-136-350 MVA

BREW, WOLTMAN & CO., INC.
52 Church St. New York 7, N. Y.

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

EBASCO SERVICES INCORPORATED
(APPARATUS EXCHANGE)
Two Rector St., New York 6, N. Y.

TURBO GENERATOR
Available Immediately
7500 KW G.E. Cr.
100 P.S.I.—525°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION
Union Electric Co. of Missouri
315 N. 12th Blvd. St. Louis 1, Mo.

DIESEL POWER

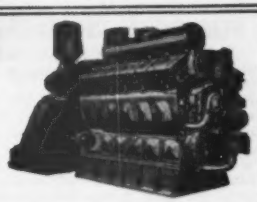
FOR

IMMEDIATE SHIPMENT

UNIT CAPACITIES—10 TO 1875 KVA

A.C.—50 AND 60 CYCLES

VARIOUS VOLTAGES



A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1500	Fairbanks Morse	32E16	2000	300	320	Buckeye	40	430	600
1150	Fairbanks Morse	38D	1600	720	320	Enterprise	10SC-6	560	450
1100	General Motors	16-278A	1600	720	300	General Motors	8-268A	450	1200
1000	General Motors	16-567B	1440	720	250	Fairbanks Morse	37-E	375	300
750	General Motors	8-567	1200	720	200	General Motors	6-268A	300	900
500	Baldwin	VO-8	750	514	100	Worthington	BB-6	150	600
500	General Motors	8-278A	750	720	100	General Motors	3-268A	150	1200
400	General Motors	8-567	720	720	60	General Motors	6-71	90	1200
400	Ingersoll-Rand	8 S	600	720	50	Internat'l Harvester	UD-16	65	1200
350	Baldwin	VO-6	510	450					

D.C. UNITS ALSO AVAILABLE

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Qu.	KW	Make	Desc.
1—	1000	G.E.	Non-Cond—190 lbs—2400-3-60
1—	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1—	750	G.E.	Condensing—385 lbs., 440-3-60 Built 1944
1—	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1—	400	Westgh.	Non-Cond.—125/150 lbs., 5/10 lbs. B.P., 240/480-3-60
1—	300	G.E.	Non-Cond.—150/175 lbs., 5/10 lbs. B.P., 480-3-60

FREQUENCY CHANGERS

KVA	Make	RPM	Voltages	Frequency
1—3750	G.E.	300	2400/4150—	
			2400/4150	25/60/25
1—3125	G.E.	300	2400/4150—	
			2400/4150	25/60/25
3—2500	G.E.	750	2400/4150—	
			2400/4150	25/62½/60/24

MOTOR GENERATOR SETS

3 ph. 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1—	2000	G.E.	514	600	6900/13200
2—	2000	G.E.	600	25 cy.	11000
1—	1500	G.E.	720	600	13200
1—	1500	G.E.	360	275	2300/4400
1—	1500	G.E.	514	250	6900/13200
3—	1000	G.E.	60	600	2300/4150
1—	1000	G.E.	900	250	4160/6900
2—	1000	Whse.	900	300	2300/4150
1—	800	Whse.	900	250	6900/11500
1—	800	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	250	2300
1—	400	G.E.	720	250	440/2300
1—	350	G.E.	900	125	4150
1—	250	G.E.	1200	125	2300
1—	150	Whse.	1200	275	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
2—1250	G.E.	HVDDJ		6900x150
1—1150	A.C.	OISC		13200x480/2400
2—1000	G.E.	HVDDJ	1	2300x480
1—500	G.E.	HT	3	24000x2340/450

BELYEA

COMPANY, INC.
OFFICE & SHOP
51 Howell St., Jersey City 6, N. J.

-TRANSFORMERS-

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries. New Transformers built to your specifications.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.
One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4160V. 2300V Pyranol
2—750 KVA G.E., 3 Ph., 4160V. 120/240V., sec.
2—400 KVA Pitts., 1 Ph., 2400/4800V pri. 240/480V sec.
3—333 KVA Whse., 1 Ph., 2400V, 600 V sec.
2—200 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
1—300 KVA G.E., 3 Ph., 2400-220 Sec.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM, 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM, 220V.
2— 150 H.P., Al. Chal. 300 RPM, 440V.

MOTOR GENERATOR SETS

1—1000 KW G.E., 600 V. 514 RPM, 4000V Sy.
1— 200 KW Whse., 275V. 900 R.P.M., 220 V Sy.
1— 175 KVA Westl., 1Ph., 220V, Motor 3Ph., 440V
1— 150 KW G.E., 125/250V, 1200 RPM, 2300 Sys.
1— 100 KW G.E., 250V, 900 RPM, 2300V Sys.
1— 75 KW C.W. 250V, 1200RPM, 2300/4160V Sys

SLIP RING MOTORS

1— 400 H.P., West. C.W. 450 RPM 550V.
1— 250 H.P., West., C.W. 600 RPM, 440V.
1— 200 H.P., West., C.W. 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3 Ph. 60 Cy.
1— 100 H.P., G.E., MT 600 RPM 440V.

Large Stock of A.C. and D.C. Equipment

NEED DIESEL-GENERATOR?
QUICK ACTION REQUIRED
CONSIDER BEST OFFER

Must move 1140 hp—1000 kva 2400 volt Baldwin-DeLaVergne-Elliott Unit. Noted for ability to burn boiler oil. Complete with all auxiliaries. Need space for larger unit to be installed. May be seen running along with 2 other duplicates which we plan to retain in Grand Haven, Michigan Municipal Power Plant.

BOARD OF PUBLIC WORKS
City Hall — Grand Haven, Mich.

CABLE-CONDUIT-ELECTRIC WIRE
In Stock for Immediate Delivery

3000 Ft. 250	MCM RHW Wire
3000 Ft. 1/0	RHW Wire
1000 Ft. 350	MCM TW Wire
1000 Ft. 4/0	RR Wire
1000 Ft. 250	RR Wire
4000 Ft. #4	RR Strd Wire
3000 Ft. #6	RR Strd Wire
10,000 Ft. #8	RR Strd Wire
10,000 Ft. #12	RR Strd Wire
20,000 Ft. ½"	Flexible Steel Conduit
15,000 Ft. 3/4"	Flexible Steel Conduit

Plus Large Stocks of other items

We also buy your surplus wire. For fast action and cash on the line send us your surplus wire list.

AMERICAN CONDUIT SALES CO
700 Berriman St. • Brooklyn 8, N.Y.

ELECTRIC CABLE
- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinary stocked by your regular supplier.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2670 N. Clybourn Ave. — Chicago 14, Ill.

WORLD'S LARGEST INVENTORY
FREE CATALOG
MOTORS-GENERATORS-TRANSFORMERS
New and Guaranteed Rebuilt
1 H.P. to 2500 H.P.
ELECTRIC EQUIPMENT CO.
P. O. BOX 51, ROCHESTER 1, N.Y.

"SEARCHLIGHT"

IS

Opportunity Advertising

—to help you get what you want.
—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"Think SEARCHLIGHT FIRST"

he's working for you

THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country — and world — penetrating the plants, laboratories and management councils . . . reporting back to you every significant innovation in technology, selling tactics, management strategy. He functions as your all-seeing, all-hearing, all-reporting business communications system.

THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it" — "they" being all the industry's front line of innovators and improvers — and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you — giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

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☆

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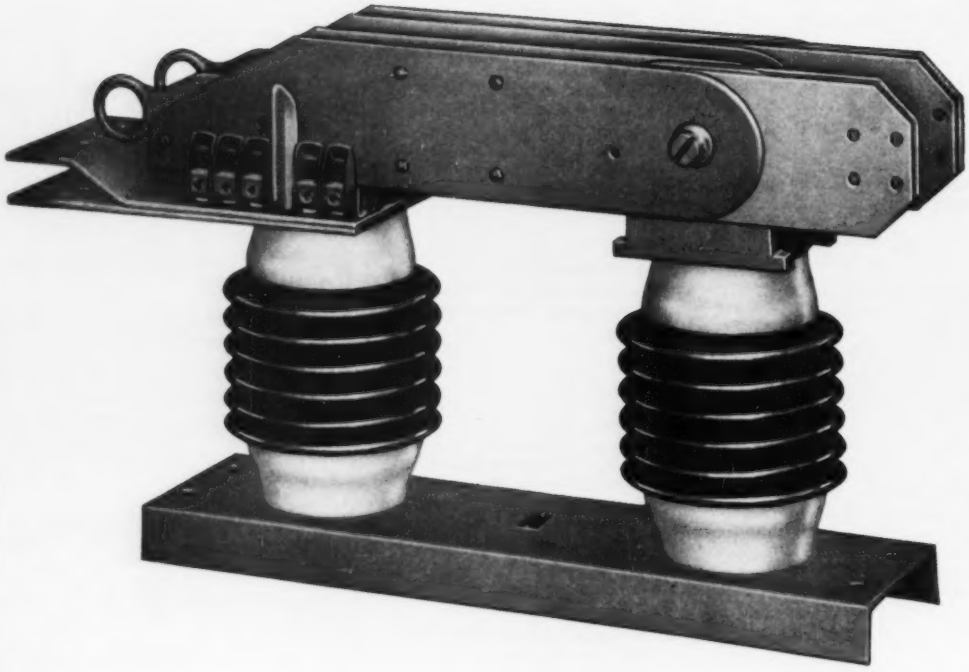
Cole Electric Co.

8439 Steller Drive — Culver City, Calif.

TExas 0-4701



OUTDOOR HOOK STICK DISCONNECTING SWITCH

23,000 Volts—4,000 Amperes—Type Y-2

Single Pole, Single Throw

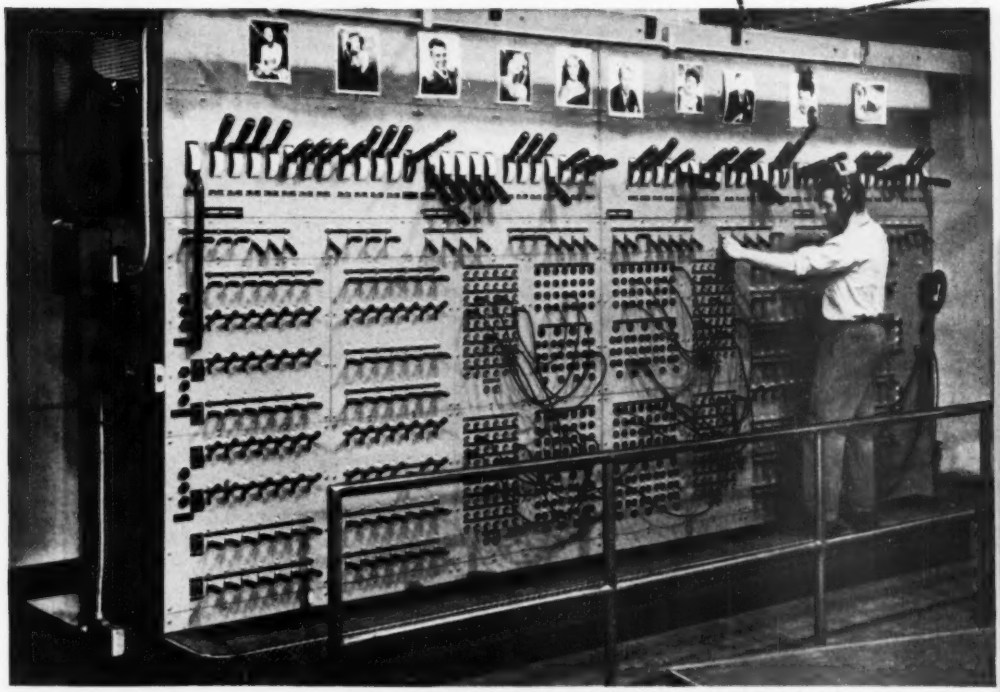
See Bulletin 20-A

SILVER TO SILVER CONTACTS

IT'S FEDERAL NOARK LIGHT CONTROL FOR

CBS *TELEVISION*

FEDERAL NOARK MEANS BUSINESS!



One of the new C. B. S. Switchboards . . . totally dead front for safe operation.

POPULAR SHOWS! Finest sets and costumes! Brilliant acting! You can have all these . . . but to put them across to the TV audience requires a stage lighting system of unlimited flexibility and velvet-smooth performance. To ensure this all-important lighting efficiency, Columbia Broadcasting System has installed Federal Noark Control Switchboards in its New York City studios.

Designed and built in one month

C. B. S. required switchboards with large capacity to permit pre-arrangement of lighting effects for a number of different sets. Each new switchboard, accordingly, controls 200 lighting circuits, any one or any group of which can be connected to any of 40 dimmers. All switches, of course, are of the silent-acting type . . . Important to C. B. S., Federal Noark designed and built these special switchboards within a month of receipt of order.

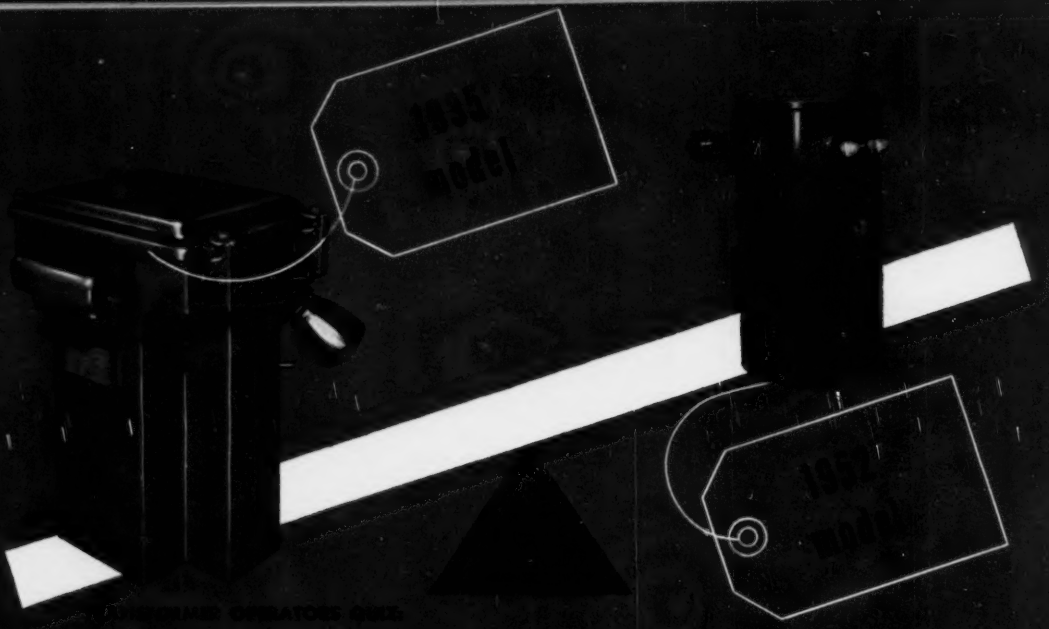
A full line of control equipment

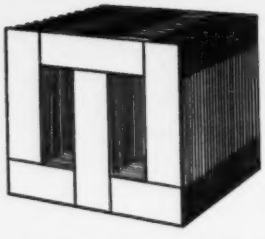
For motion picture houses, theatres, clubs, auditoriums, schools, churches, recreation centers — wherever lighting effects must be regulated — Federal Noark switchboards and controls are tops. Likewise, throughout the whole range of electric control equipment, a host of unique developments has brought huge demands for Noark products. In a few short years, Federal Noark has become one of the largest designers and manufacturers in its field. Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

FEDERAL NOARK

Federal NOARK

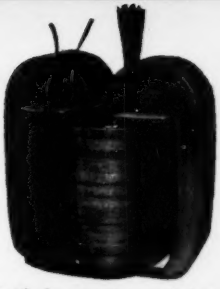
Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.





This is the old, pre-1935 butt end transformer core, which had several joints of appreciable flux densities and in which much of the magnetic material was fluxed against the grain.

The first step toward a better design, with the magnetic material fluxed parallel to the grain, therefore reducing both circuit reluctance and exciting current and greatly improving space factor.



First of the wound core designs—the great Kuhlman Bent Iron Core! Note it has only one joint in each branch of magnetic circuit, reducing reluctance; more efficiently utilizes materials in their most desirable characteristics, thereby making a smaller, lighter transformer.

Kuhlman ELECTRIC COMPANY, BAY CITY, MICHIGAN K E